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Pinhey (E. C. G.). **The Sunn Hemp Beetles.**—*Rhod. agric. J.* **44** no. 2 pp. 74–81, 1 fig., 1 ref. ; also as *Bull. Minist. Agric.* [*S. Rhod.*] no. 1388, 9 pp., 1 fig., 1 ref. Salisbury, 1947.

Galerucids of the genus *Exora* were first recorded damaging sunn-hemp (*Crotalaria juncea*) in Southern Rhodesia in 1926. Since then they have increased in numbers by breeding on successive crops until in 1944–45 populations at Salisbury Experimental Station were estimated at over $3\frac{1}{2}$ million per acre. The species concerned are *E. discoidalis*, Jac., *E. apicipennis*, Jac., and *E. kohlschütteri*, Weise ; their appearance is briefly described, and characters distinguishing them from other beetles with which they might be confused are given. Sunn-hemp is grown in Southern Rhodesia chiefly as a weed-suppressing green-manure crop, and also for hay, compost and seed and as a cover-crop in orchards, and is the most suitable hay and green-manure crop plant of those available. Both seed-production and its value as a fertiliser are reduced as a result of attack. The adult beetles kill many of the seedlings and feed on the leaves of older plants, and though the latter do not as a rule succumb, they may be damaged later in the season by the larvae, which feed on the roots and injure the bacterial nodules.

The beetles emerge from the soil soon after the first heavy falls of rain in November. They can survive for 2–3 weeks without food and in dull or wet weather seek shelter before migrating to sunn-hemp. They also attack native species of *Crotalaria* and a species of *Eriosema*, and have been reported on many other plants, though they probably do not feed on these. In the laboratory they fed readily only on sunn-hemp and other species of *Crotalaria*, though *Eriosema* was attacked and minor damage caused to haricot-bean seedlings. Over-ripe orchard fruit has been attacked when sunn-hemp was not available. The adults are present for nearly two months, and the eggs, which are laid singly in moist soil near the food-plant at depths of not more than two inches, hatch in about a fortnight. The larvae feed on the root nodules or, if these are not yet developed, on the lateral roots and the tap-roots, and if an infested crop is ploughed under, they may attack the roots of the crop that replaces it. They continue to feed until about the end of March and then construct earthen cells at a depth of 6–12 ins., in which they remain in diapause throughout most of the dry season. They pupate when the weather becomes warmer, and the adults emerge 3–4 weeks later, though they do not leave the soil until after rain ; resting adults have been found towards the end of October. Natural enemies, which include insectivorous birds, nematode and hymenopterous parasites and fungi, exert little control.

Lead arsenate sprays are effective against the adults, and, in experiments, dusts containing 5 per cent. DDT or 0·5 per cent. Gammexane [γ benzene hexachloride] applied at a rate of 20 lb. per acre gave 98 per cent. control, but these treatments are costly. At present, spraying is recommended only for trap-crops of sunn-hemp, which should be planted as early as possible in November and sprayed with 1 lb. lead arsenate in 40 gals. water, with a spreader, as soon as they become heavily infested ; 30–50 gals. spray suffices for an acre of plants 6–12 ins. high. The treatment should be repeated after heavy rain. Cultural measures, which are of greater importance, comprise delaying sowing until the third week of December or, if the rains are late, the first week in January, to avoid adult attack ; deep ploughing of infested land, preferably in March–April (the usual time if the crop is for green manure) and again in October to destroy the larvae and pupae ; setting successive crops of sunn-hemp n fields as far apart as possible ; and substituting other crops for sunn-hemp or two or three years. The first of these measures is frequently inconvenient nd the last, if carried out on a co-operative basis, would be the most ffective.

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AHLBERG (O.). *Aspidiotiphagus kemneri* **n. sp. (Hym. Chalcididae, Aphelininae).** [*In German.*]—*Opusc. ent.* **12** pt. 1–3 pp. 116–117, 1 fig. Lund, 1947.

Aspidiotiphagus kemneri, sp. n., is described from females reared from *Aspidiotus hederae,* Vall., on *Kentia* sp. in 1925 and from *Diaspis bromeliae,* Kerner, on various palms in 1945 ; the localities are not stated.

RICHARDS (O. W.) & WALOFF (N.). **Seasonal Variations in the Numbers of some Warehouse Insects.**—*Proc. R. ent. Soc. Lond.* (A) **22** pt. 1–3 pp. 30–33, 1 ref. London, 1947.

Notes are given on the seasonal occurrence of some 20 other insects observed in a granary in London in the course of a study of a population of *Ephestia elutella,* Hb., on bulk wheat [*R.A.E.*, A **36** 210–213]. Adults of *Ptinus tectus,* Boield., occurred between 3rd June and 11th November in 1943 and were present in 1944 in small numbers between 17th May and 12th July and thereafter in larger, variable numbers up to 7th December. Observations in 1943 in which trays of wheat were exposed for oviposition and then incubated [*cf.* **36** 211] showed that no larvae hatched before 8th July, but the estimated numbers for the whole room for the six succeeding weeks were 2,400, 34,300, 22,800, 8,400, 5,800 and 5,500. Other insects that occurred in small numbers included *E. kuehniella,* Zell., of which adults were seen from 3rd to 12th August and from 14th October to 4th November in 1943 and occasionally during July–October in 1944. Rolls of corrugated paper were exposed in the wheat for a week from 29th September 1943 to trap wandering larvae and then left in the granary, and samples from them were examined on various dates between 8th November 1943 and 14th June 1944. All the 61 examples of *E. kuehniella* found in the samples were pupae, and it is concluded that there is no larval diapause, that the pupae can withstand the winter temperatures, and that the life-cycle in unheated warehouses is irregular, so that the moths could probably be found in almost any month of the year.

THORPE (W. H.), CROMBIE (A. C.), HILL (R.) & DARRAH (J. H.). **The Behaviour of Wireworms in Response to Chemical Stimulation.**—*J. exp. Biol.* **23** no. 3–4 pp. 234–266, 1 pl., 11 figs., 36 refs. London, 1947.

The following is from the authors' summary. The behaviour of larvae of *Agriotes lineatus,* L., *A. obscurus,* L., and *A. sputator,* L., in relation to food and to chemical substances of plant origin was investigated by means of various types of olfactometers and choice chambers and by field experiments. *A. lineatus* and *A. obscurus* cannot be distinguished in the larval stages, but, when possible, results obtained with these two were checked with those obtained with *A. sputator,* and no significant differences were found. Although wireworms when seeking food will, under exceptional conditions, move over the soil surface, it was not possible to detect any response to odours under such conditions [*cf. R.A.E.*, A **33** 123]. When wireworms encounter certain plant juices or solutions containing either one or more of a number of carbohydrate, fatty or protein substances, the biting response is elicited. Of the carbohydrates, all the sugars tested elicited biting, certain common plant sugars being among the most active in this respect. It appears that the polyhydric alcohol grouping is responsible for activity, as in the case of the human sense of sweetness. The pH activity curve for biting (tested on glucose) showed a marked peak between 6 and 8 ; most plant juices have a pH value of between 5 and 7. Triolein was the only pure fat to which the wireworms were found to give the biting response, but the sodium salts of certain fatty acids were active in this respect. The proteins found to be active in eliciting biting are of animal origin, while the plant proteins tested were inactive. Partially broken down proteins may be active though the parent proteins were not, but none of the amino-acids or mixtures of amino-acids tested proved active. As with the feeding of a number of other insects, the threshold for biting was lowered progressively with starvation up to seven days.

In a chamber filled with sand or soil, wireworms tended to collect in the side in which the medium was moistened with aqueous extracts of plant tissues and to desert the side in which it was moistened with an equal quantity of water. This orientation was induced by a number of the substances that cause the biting response and also by aqueous solutions in very low concentrations of several dibasic acids and amides (such as aspartic acid and asparagine) and related substances that are widely distributed in plant tissues. The sensitivity for orientation tended to vary with the nutritional state (as well as with season and time in relation to moult), as it did for biting. Orientating wireworms were sensitive to a gradient of active substances, and orientation was shown to be partly the result of orthokinesis and partly of a type of behaviour that partakes of both klinokinesis and klinotaxis.

Field experiments with artificial baits indicated that burrowing, following the lines of least resistance in the soil but random in respect to chemical stimulation, is the primary basis of food finding. With paper-pulp blocks containing glucose or triolein as artificial baits, random burrowing combined with orthokinesis and the biting reaction will cause a very considerable rate of catching. The extreme sensitivity to asparagine and related substances conferred no significant advantage when tested with a large rectangular paper-pulp bait, but, on the assumption that such substances are set free into the soil by the roots, it is regarded as a means of increasing the attractive area of a root system and of retaining the insect in the vicinity of fine roots once they have been encountered, so serving as a fine adjustment in the food-finding process.

In a discussion of the prospects of developing the bait method in practical control, which are regarded as encouraging, it is suggested that combinations of a stable bait substance that is insoluble in water with a non-repellent contact poison might provide a method of widespread application for protecting the critical early stages of crops, and that further research should be directed along these lines.

DICKER (G. H. L.). **The Strawberry *Rhynchites* and its Control.**—*Grower* **27** pp. 391, 393–394, 423–425, 1 fig., 1 ref. London, 1947.

Rhynchites germanicus, Hbst., has in recent years caused serious damage to strawberry in England [*R.A.E.*, A **36** 358], notably in the south-east. It is often associated with *Anthonomus rubi*, Hbst., but whereas adults of the latter puncture the stalks of flower buds, causing them to fall individually, those of *R. germanicus* girdle the stems of the young leaves and flower trusses with punctures, causing both these to wither and die. Both weevils also attack *Rubus* spp. There is a similar difference in damage to raspberry, blackberry and loganberry, as *A. rubi* again confines its attack to the flower buds, whereas *R. germanicus* usually girdles the tips of the young canes, causing them to branch, and on blackberry, severs the terminal part of the flower trusses. Adults of *R. germanicus* emerge from hibernation between March and early May. The first adults feed on the unfolding leaflets of strawberry ; some leaves begin to wilt by mid-April owing to feeding punctures in the stems, but no damage of importance occurs until oviposition begins. Eggs are first found about the third week in April, when some flower trusses are appearing above the crowns, and the larvae feed in the withered leaf or flower truss. In one area in Kent in 1945, 50 per cent. of the flowers dropped in many plots as a result of attack and all the young growth of some plants was destroyed by the end of May.

Since the adults continue to emerge for about a fortnight after oviposition begins, protection for at least that period is necessary. In laboratory tests, dusts containing 1, 3 or 5 per cent. DDT gave over 90, 100 and 100 per cent. mortality of the adults, and one containing 3 per cent. BHC (benzene hexachloride) only 50 per cent. In 1945, when strawberry developed a fortnight earlier than usual, heavily infested plants were dusted with 3 per cent. DDT at a rate of 24 lb. per acre on 21st April. Two days later, few living weevils were found and no more were seen until 8th May. In 1946, dusts containing 3 and 5 per cent. DDT and 5 per cent. BHC were applied at 20–23 lb. per acre on 20th April, when eggs were first found, and the percentages of damaged plants in the three plots and an untreated one on 3rd and (in brackets) 17th May were 1 (4), 1 (0), 18 (27), and 21 (29). On the basis of these experiments, a dust containing 3 per cent. DDT at a rate of 28 lb. per acre is recommended. It should be applied to strawberry when the first flower trusses become visible and directed into the crowns. Cultivated blackberry should be treated as soon as injury to the tips of the young blossom trusses is observed, usually in early May. Damage to raspberry and loganberry continues until August, but is not of importance under field conditions ; dusts can be applied if considered desirable. If *A. rubi* is also present on strawberry, the 5 per cent. dust should be used and a second application made after 10–14 days.

WENE (G.). **An Effect of sub-lethal Doses of Cryolite on Mexican Bean Beetle Larvae,** *Epilachna varivestis.—Ohio J. Sci.* **47** no. 3 pp. 117–118, 3 refs. Columbus, Ohio, 1947.

It has been observed that some larvae of *Epilachna varivestis*, Muls., and *Pieris* (*Ascia*) *rapae*, L., that feed on leaves treated with cryolite cease to feed before they have ingested a lethal dose and suffer retarded development. In order to ascertain whether this retardation is due to inadequate feeding or to physiological effects of the poison, larvae of *E. varivestis* that had recently moulted were subjected to starvation and to sub-lethal doses of micronised natural cryolite containing 90 per cent. sodium fluoaluminate on bean leaves, the deposit being 0·0313 mg. per sq. cm. The duration of the third instar was increased from 2·6 days for continuous feeding on untreated leaves to 3·4 and 4·3 days by starvation for one and two days, respectively, and to 4·8 and 5·8 days by feeding for one and two days, respectively, on treated leaves before being transferred to untreated ones. There was no mortality among larvae fed continuously on clean leaves or starved for one day, but the percentages of larvae that survived when starved for two days or fed for one or two days on treated leaves fell to 76·8, 47·3 and 44·1, respectively. The duration of the fourth instar was increased from 5·3 to 6·5 and 9·3 days by starvation for one and three days, and to 8·1 and 10·3 days by feeding on treated foliage for one and two days ; the corresponding reductions in percentages that survived were from 97·1 to 94·1, 79·1, 61·4 and 24·7.

Five third-instar larvae consumed 80 per cent. of the area of a leaf in 24 hours, but five that had been starved for one day ate 80 per cent. of two leaves. Five others ate less than 2 per cent. of a leaf treated with cryolite in the same period and about the same amount of an untreated leaf on the following day. In addition to killing some larvae, cryolite thus also reduces the injuriousness of the survivors, and may therefore be more effective than mortality records indicate.

LANGE (E. G.). **Erstauftreten der San-José-Schildlaus in der Pfalz und die zu ihrer Abwehr eingeleiteten Massnahmen.** [The first Appearance of the San José Scale in the Palatinate and Measures introduced for its Control.]—*Festschr. Appel 1947* pp. 22–23. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

Soon after *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., was found in the Bergstrasse, east of the Rhine, in the spring of 1946 [*cf. R.A.E.*, A **37**

118], it was discovered in a village near Speyer, on the west bank, infesting currant, apple and pear and to a less degree stone fruits. The infestation was traced to two nurseries, which proved to be heavily infested, but it was not known how the scale reached these. A survey of the whole Palatinate showed that infestation was common round Speyer and Ludwigshafen, but none could be found in Rheinhessen, to the north. The control measures adopted, which were accompanied by a publicity campaign, were fumigation with hydrocyanic acid gas of all stock to be despatched from four nurseries found infested, the restriction of movement of nursery stock from and into the most heavily infested area, and the application of dormant oil sprays to all fruit trees and bushes in the infested districts. Plants that could not be treated in winter were to be sprayed with summer oil during the following summer. As a substitute for winter oil, a combination of a tar distillate (emulsified carbolineum [*cf.* **35** 70]) with sodium carbonate and a wetting agent gave good results.

HEINZE (K.). **Ueber Spritzversuche an Kartoffeln zur Bekämpfung der virusübertragenden Blattläuse.** [Spray Tests on Potato for the Control of the Aphids that transmit Virus Diseases.]—*Festschr. Appel 1947* pp. 31–34. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

Experiments on the value of controlling Aphids, particularly *Myzus* (*Myzodes*) *persicae*, Sulz., to reduce the spread of virus diseases of potato and the effectiveness of various sprays for this purpose [*cf.* *R.A.E.*, A **27** 157] were begun in four districts of Germany in 1938. The sprays tested included Bordeaux mixture, alone and with nicotine, nicotine alone and with soft soap, hexaethyl tetraphosphate (Bladan), parathion (E 605 f), and two preparations of DDT. They were applied in June and July at intervals of 7 or 14 days, but the concentrations and rates of application are not stated. Their effectiveness was estimated from the numbers of Aphids per plant before and after treatment and the percentage of virus infection among plants grown from seed potatoes harvested on the treated and untreated plots.

Bordeaux mixture alone was the least effective treatment, and no spray containing nicotine prevented rapid reinfestation by Aphids. DDT reduced their numbers little, but parathion and hexaethyl tetraphosphate gave excellent control, though their toxicity was less persistent than was expected. On the whole, the tests showed that controlling the Aphids reduced the proportion of plants that became infected with virus disease and is worth while in years of heavy infestation, particularly in the case of seed-potatoes or experimental plots. The number of sprays to be applied should be determined by the severity of the infestation, especially that by *M. persicae*. Treatment is usually necessary when the numbers of *M. persicae* per 100 leaves from the top, middle and lower parts of the plants exceed 10–15, but rainy or cold weather or a falling population may render it superfluous. The sprays should be applied so as to wet the lower surfaces of the leaves, and the field kept free from infected plants. The control of Aphids can be combined with that of the potato beetle [*Leptinotarsa decemlineata*, Say] or fungous disease, and in this connection it is noted that parathion is compatible with calcium arsenate and Bordeaux mixture.

GÖRNITZ (K.). **Erfahrungen bei der Rapsglanzkäfer- und Fliegenbekämpfung mit Gesarol.** [Experience in the Control of *Meligethes aeneus* and Flies with Gesarol.]—*Festschr. Appel 1947* pp. 41–44, 2 refs. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

This paper, part of which is noticed elsewhere [*R.A.E.*, B **37** 216], contains an account of experiments in Prussian Saxony in 1944–46 with a proprietary

DDT dust against *Meligethes aeneus*, F., on rape and other crucifers grown for seed. In 1944, dusting in April in very windy weather, which rendered the deposit very light, gave almost complete control of the beetles on rape, but a light application in warm weather at the end of May proved insufficient. The necessity for a heavy application during warm weather was confirmed in 1946. In 1945, thorough dusting in April and May eliminated the beetles, but did not prevent the rape from being severely attacked in late May and again in late June by *Dasyneura brassicae*, Winn., which destroyed most of the pods. The Cecidomyiid was probably favoured by the early development of the pods on the dusted plot.

Sy (M.). **Versuche zur Wirkungsbreite des Gesarols.** [Experiments on the Scope of Action of Gesarol.]—*Festschr. Appel 1947* pp. 44–47, 5 refs. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

The results are given of work in Hanover in 1946 in which DDT was tested against various insects and mites. Proprietary preparations were used in most cases. In the field, sprays gave good control of *Hyponomeuta padellus malinellus*, Zell., on apple, but were useless when applied to the trunks against larvae of *Cydia* (*Laspeyresia*) *pomonella*, L., seeking sites for pupation. Dusts gave good control of *Sitona lineatus*, L., on peas, and also of *Lilioceris lilii*, Scop., on lilies, and dusts and sprays gave complete mortality of *Nematus* (*Pteronus*) *ribesii*, Scop., on gooseberry and also good control of *Crioceris duodecimpunctata*, L., and *C. asparagi*, L., but not *Platyparea poeciloptera*, Schr., on asparagus. A dust was ineffective against *Dermestes lardarius*, L., in a curing room.

In tests against larvae of *Sciara* (*Neosciara*) *tritici*, Coq., in the potted soil in which orchids were grown under glass, an emulsified solution of DDT gave the best results, though it caused some scorching of certain genera of orchids dipped in it or watered with it.

Among species tested in the laboratory only, larvae of *Euproctis similis*, Fuessly (*Nygmia phaeorrhoea*, Don.) were readily destroyed by dusts and sprays of DDT. Sprays were effective against *Malacosoma neustria*, L., but a dust much less so, and dusts but not sprays gave complete mortality of *Anomala* (*Phyllopertha*) *horticola*, L. Only direct contact with an emulsion spray had any effect on *Aphis* (*Doralis*) *pomi*, Deg., and *Myzus cerasi*, F., and neither dusts nor sprays affected *Paratetranychus pilosus*, C. & F., when applied shortly before the eggs hatched, or *Tyroglyphus farinae*, Deg., when wheat infested by it was shaken up with them.

Schilder (F. A.). **Die Rüssellänge der Reblausrassen. (Vorläufige Mitteilung.)** [The Length of the Proboscis of the Races of the Vine Aphid. Preliminary Communication.]—*Festschr. Appel 1947* pp. 53–54, 16 refs. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

Börner claimed in 1910 that *Phylloxera* (*Daktulosphaira*) *vitifoliae*, Fitch, could be divided into two biological races on the basis of its mode of attack on vines and later considered that these races (*vitifoliae* and *vastatrix*, Planch.) could be distinguished by differences in the number of marginal tubercles of the adult root Aphids and in the length of the rostral setae of the nymphs, especially of the first instar, of either the root or leaf Aphids [*cf.* *R.A.E.*, A **11** 342 ; **12** 556]. The existence or validity of these differences has been denied [*cf.* **12** 557 ; **15** 559 ; **28** 327] by workers who may have used mixed populations of the two races or populations of leaf Aphids that included some root Aphids produced on leaves, but their existence has been confirmed by Russian workers [*cf.* **17** 306–307, 689] and they have been used with success in Germany for some time in investigations on the distribution of the two races [*cf.* **27** 688 ; **31** 381].

Since 1925, preparations of some 60,000 first-instar nymphs of the leaf form and overwintering root Aphids from over 4,000 different sources have been examined at Naumburg and the rostral setae measured. Börner's index, obtained by dividing the length of the setae by that of the hind tibia, has proved unnecessary, since the length of the tibia is about the same in the two races. The length of the setae alone gives a clearer picture, and it is no less accurate and much less liable to error than the difference between the second labial joint and the hind tibia, which was recently proposed by Börner but involves very small measurements.

The results of the work showed that the average length of the rostral setae for successive periods of three years between 1924 and 1944 of a strain from the Palatinate propagated parthenogenetically as leaf Aphids at Naumburg varied irregularly between 165 and 171μ only, so that there was no gradual lengthening of the setae in response to a less favourable climate, as has been thought possible. There was also no clear variation with season in the average length for either race. On the other hand, there was a regular increase from the first spring generation of the year to the overwintering form in the root Aphids of either race propagated on roots. When the averages for various strains of leaf Aphids bred parthenogenetically from individual fundatrices (May-gall Aphids) were arranged in groups varying by 3μ from 117 to 183μ and plotted against their frequency, a curve with two peaks was obtained. The forms with short and long setae had averages of 134 and 164μ and ranges of 108–153 and 141–192μ, respectively, and the transition from one form to the other occurred at 150μ. In experiments on crossing the two forms of leaf Aphids, the length of the setae was a hereditary character, short setae being dominant. After the first moult, the average length of the setae of leaf Aphids increased from 134 to 147μ in race *vitifoliae*, but decreased from 168 to 157μ in the Palatinate strain of race *vastatrix* ; in the third, fourth and fifth instars, there was practically no difference between the two races. Among root Aphids, the averages appeared to give a curve with only one peak and the average of all lengths was 207μ. On biological grounds, however, it is evident that two closely overlapping curves are involved, with averages of 198 and 213μ and ranges of 162–219 and 171–231μ, respectively, and that these represent the two races *vitifoliae* and *vastatrix*.

BEHR (L.). **Die Wurzelfliege** *Hylemyia radicum* **L. an Buschbohne.** [The Root Fly, *H. radicum*, on Kidney Beans.]—*Festschr. Appel 1947* pp. 54–55, 23 refs. Berlin-Dahlem, Biol. ZentAnst. Land- u. Forstw., 1947.

Severe injury to the root collars of young bean plants in two distinct localities near Aschersleben, Saxony, in July 1946 was found to be due to tunnelling by larvae of *Hylemyia radicum*, L. It is concluded from a review of the literature on this Anthomyiid that it chiefly attacks crucifers, infestation of other plants, including beans, having only occasionally been recorded.

JANJUA (N. A.) & MEHRA (R. N.). **The Biology of** *Quettania coeruleipennis* **Schwarzer (Coleoptera) in Baluchistan.**—*Bull. ent. Res.* **40** pt. 2 pp. 203–206, 3 refs. London, 1949.

In view of the increasing importance of *Quettania coeruleipennis*, Schwarzer, as a pest of fruit trees in Baluchistan, investigations on its life-history were made in 1943–46. The immature stages of this Cerambycid are described. It was recorded from apricot stems at Quetta in 1927 and subsequently from cherry [*cf. R.A.E.*, A **30** 380] ; it is now a major pest of almond and pomegranate and also attacks plum and quince. Infestation is most severe at Quetta and Loralai, and old trees are the most susceptible to attack. The eggs are laid singly on the top shoots and small branches, and the larvae enter these and tunnel downwards. The hollowed shoots and branches dry up and are blown off by moderately strong winds ; the dead leaves remain attached to them even in winter. The larva pupates in a wide chamber made at the end of the tunnel and closed by wood dust. During the period under investigation, adult emergence and (in brackets) oviposition began between 5th (7th) and 15th (18th) May and ended between 18th (22nd) May and 29th May (3rd June), and the eggs hatched in 12–19 days. The feeding period of the larvae ranged from 265 to 317 days, and the prepupal and pupal stages lasted 7–12 and 25–36 days, respectively. The average number of eggs deposited per female was 59·7 and the maximum 74.

Pradhan (S.). **Studies on the Toxicity of Insecticide Films. II. Effect of Temperature on the Toxicity of DDT Films.**—*Bull. ent. Res.* **40** pt. 2 pp. 239–265, 2 pls., 11 figs., 39 refs. London, 1949.

The following is based almost entirely on the author's summary of this second paper of a series [*cf. R.A.E.*, A **37** 326], in which an account is given of experiments on the relation between temperature and the toxicity of dry films left by sprays of DDT to adults of *Tribolium castaneum*, Hbst., and larvae of *Plutella maculipennis*, Curt. The temperatures tested ranged from 56 to 95°F. The mortality varied directly with temperature when the insects were exposed continuously to the films and inversely with it when insects that had been exposed at the same temperature were subsequently kept at different ones. When insects that had been exposed to the film at different temperatures were subsequently transferred to the same one, mortality was highest among adults of *T. castaneum* that had been in contact with the film at high temperatures and larvae of *P. maculipennis* that had been in contact with it at low ones ; the larvae were observed to cover the film with considerably more silken threads at high than at low temperatures, and thus avoided contact with the film to a greater extent. Some evidence was obtained in a preliminary experiment with *Tribolium* that the toxicity of the film was increased by high humidity.

A review of the literature made in the light of these conclusions indicated that many of the observations made upon the relation between temperature and toxicity can be accounted for by the following generalisations. The resistance of insects to poisons resembles their other vital functions in changing with temperature, increasing up to a critical degree and then declining. The amount of poison that reaches the site of action in unit time also varies with the temperature, generally, but not always, increasing as it rises, and insect activity, especially locomotion and respiration, may play an important part in determining it. The apparent effects of temperature on insecticidal action result from combinations of these two factors.

Gough (H. C.). **Studies on Wheat Bulb Fly,** *Leptohylemyia coarctata*, **Fall. III. A Survey of Infestation in Yorkshire.**—*Bull. ent. Res.* **40** pt. 2 pp. 267–277, 2 figs., 3 refs. London, 1949.

The following is based on the author's summary of this third part of a paper [*cf. R.A.E.*, A **34** 367 ; **35** 164]. A quantitative survey of infestation by *Hylemyia* (*Leptohylemyia*) *coarctata*, Fall., was made in Yorkshire in 1945, and the distribution of the fly there, which is shown on a map, is discussed in relation to general observations and records in the years 1935–46. A total of 136 wheat and rye fields on 86 farms was sampled, and *H. coarctata* was found to be present in over half the farms and fields. It was present in moderately high numbers (over 100,000 larvae per acre) in eight fields, and in two of these it was sufficiently numerous (over 300,000 larvae per acre) to be likely to cause the wheat crop to fail in a bad year. It was estimated that wheat and rye over an area of 2,000–3,000 acres in Yorkshire are likely to produce reduced crops as a result of attack by *H. coarctata* in an unfavourable season, and over half this area is near Selby. The only large arable area from which the fly was virtually absent was the Yorkshire Wolds. High larval counts and wheat failures occur mainly on light land after potatoes and heavy land after fallows [*cf.* **34** 367], but at least one area was found where wheat and rye regularly followed potatoes on light land, but where *H. coarctata* was present in only very low numbers.

WAY (M. J.). **Laboratory Experiments on the Effect of DDT and BHC on certain Aphidophagous Insects and their Hosts.**—*Bull. ent. Res.* **40** pt. 2 pp. 279–297, 33 refs. London, 1949.

A detailed account is given of experiments in England in 1945 and 1946 on the effect of insecticides, particularly DDT and BHC (benzene hexachloride), on Syrphids, mainly *Syrphus ribesii*, L., *S. luniger*, Mg., and *Lasiophthicus* (*Catabomba*) *pyrastri*, L., and Coccinellids (*Coccinella septempunctata*, L., and *Adalia bipunctata*, L.) that devour Aphids, on two Braconid parasites of Aphids, and on the Aphid hosts of these insects. The insecticides mainly used were a 0·2 per cent. w/v DDT spray prepared from Guesarol E, a suspension of 0·1 per cent. w/v DDT crystals in the form of flat hexagonal plates ($60\times15\mu$), a proprietary dust of 5 per cent. w/w DDT, a proprietary BHC spray powder at concentrations giving 0·026 and 0·013 per cent. w/v γ isomer, a BHC dust at 0·2 per cent. w/w γ isomer, a spray of derris and soap with a rotenone content of 0·01, 0·005 or 0·0025 per cent., and a spray containing 0·06 per cent. v/v nicotine.

When adult Syrphids were caged with treated infested cabbage, the weaker BHC spray gave complete mortality in 24 hours and caused colonies of *Myzus persicae*, Sulz., on the unsprayed lower surfaces of the leaves to fall to the ground, presumably as a result of fumigant action. The proprietary DDT dust and spray were moderately toxic to the Syrphids but had no effect on *M. persicae*. The dust was also toxic to adult Syrphids caged with a bunch of treated white mustard blossom. When cabbage plants treated with DDT were infested with *Brevicoryne brassicae*, L., and adult Syrphids caged with them, the DDT suspension inhibited the development of the Aphids and killed 90 per cent. of the Syrphids in three days. The proprietary DDT dust and spray had no effect on the Aphids and gave much less mortality of the Syrphids. Scarcely any eggs were laid by the latter, though the treated plants did not appear to be repellent.

The only material that had any effect when applied directly to Syrphid larvae was the BHC spray, which killed young examples. The larvae were also resistant to continuous contact with spray residues and dusts, only the stronger BHC spray giving significant mortality ; the deposit was probably heavier than it would be on plants in the field. In a further test, bean plants bearing large numbers of *Aphis fabae*, Scop., and Syrphid larvae were treated ; the BHC sprays gave high mortality of Syrphids and Aphids in two days, derris and nicotine killed the Aphids but not the Syrphids, the proprietary DDT spray and the BHC dust killed many Aphids but few Syrphids, and the DDT dust had a negligible effect on both.

In tests with *Coccinella septempunctata*, in which adults were sprayed or dusted with the insecticides, the sprays of BHC and derris (0·1 per cent. rotenone) and the DDT dust gave 44–50 per cent. mortality in four days, and the proprietary DDT spray and nicotine gave 25 and 0 per cent., respectively. When cabbages treated with DDT were infested with *B. brassicae* and caged with *Coccinella* adults in August, the dust and the suspension both prevented the development of the Aphids, and the dust but not the suspension gave very high mortality of the Coccinellids ; the proprietary spray had no effect on the Aphids but killed many Coccinellids. Toxicity to *A. bipunctata* was comparable but rather more rapid. The derris spray even at only 0·0025 per cent. rotenone gave high mortality of the eggs of both Coccinellids on bean leaves, while the proprietary DDT and the BHC sprays killed the larvae on hatching ; the BHC dust and the nicotine spray had no effect. Half-grown larvae of *Coccinella* subjected to direct sprays were very susceptible to derris, moderately so to the proprietary DDT and only slightly so to BHC.

In tests with adults of the Braconids, *Aphidius brassicae*, Marsh., and *A. matricariae*, Hal., the results were complicated by the high natural mortality occurring in cages. When adults of the former were caged with treated cabbage, the DDT suspension and proprietary spray gave 100 and 57 per cent. mortality in four days, as compared with 22 for no treatment, while the BHC spray at the lower strength and the BHC dust gave complete mortality within a few hours. Under similar conditions, a turnip plant sprayed with BHC killed all the adults of *A. matricariae* within a few hours and remained toxic to them for at least three weeks. Colonies of *M. persicae* on the lower surfaces of the leaves were destroyed by spraying the upper surfaces with BHC. Larvae of a predacious Cecidomyiid thought to be *Phaenobremia* sp. on stinging nettle (*Urtica dioica*) were very susceptible to BHC and only slightly less so to DDT.

MAQSUD NASIR (M.). **Recent Work on Mercury as an Insecticide against Insect Pests of stored Grain.**—*Bull. ent. Res.* **40** pt. 2 pp. 299–304, 12 refs. London, 1949.

In view of conflicting opinions as to the way in which mercury should be used to protect stored grain from insect attack, various methods are reviewed from the literature, and an account is given of experiments in which some of them were tested at Quetta in 1944. With eggs of *Trogoderma granarium*, Everts, as test insects, mercury was found to give complete mortality within a radius of three feet in airtight receptacles that were empty or filled with sorghum, and this agrees with a recent unpublished finding that the diffusion of mercury vapour is equal in all directions, with an effective range of 37 ins. Mercury is more effective in the form of fine drops dispersed on a dust carrier than as an amalgam [*cf. R.A.E.*, A **18** 30 ; **32** 418] or a coating on a copper plate [**31** 351] ; the use of porous paper strips coated with droplets of mercury has been advocated, but they cannot be recommended for use in grain for consumption that is stored in stacked bags, since they did not prove satisfactory in sorghum, and evidence was obtained that the mercury could be dislodged from the strips by the pressure of the grain or even by shaking. Mercury dispersed in chalk and mixed with sorghum that was subsequently infested with adults of *Calandra* (*Sitophilus*) *oryzae*, L., *Rhizopertha dominica*, F., and *Tribolium castaneum*, Hbst., and eggs of *Corcyra cephalonica*, Staint., and *Sitotroga cerealella*, Ol., effectively protected it from injury for six months, but this method is recommended only for seed grain, since it was suspected that some of the mercury became mixed with the sorghum and was not completely removed by sieving. Slabs that could be hung on the walls of storage receptacles [*cf.* **32** 418] were prepared by mixing the chalk and mercury with plaster of paris and proved effective in killing eggs of *C. cephalonica* in glass jars with a capacity of 3,600 cc. Such slabs, and also pastes for plastering the walls, are of no value in storerooms, however, owing to the limited effective range of mercury vapour. In a test in which air saturated with mercury vapour was drawn for five minutes through a flask with a capacity of 300 cc., with and without grain, which was then sealed, the vapour caused complete mortality of eggs of *C. cephalonica*, but had little effect on mature larvae, pupae or adults, and fumigation with mercury is therefore not considered practicable. In another experiment at a temperature of 78–82°F. in which the eggs were exposed in desiccators containing mercury, newly laid eggs and eggs that had been deposited 24 hours previously required an exposure of at least 72 hours for complete mortality, eggs deposited 48 hours previously required only 48 hours, and eggs deposited 72 hours previously were unaffected and hatched after 24 hours [*cf.* **33** 164]. Temperatures within a range of 20–35·5°C. [68–95·9°F.] and relative humidities of 53–90 per cent. did not affect the toxicity of the vapour to the eggs.

SMITH (M. S.). **Persistence of D.D.T. and Benzene Hexachloride in Soils.**—*Ann. appl. Biol.* **35** no. 4 pp. 494–504, 1 fig., 14 refs. London, 1948.

The following is virtually the author's summary. Acid and alkaline soils, both alone and mixed with 2 per cent. DDT or 2 per cent. BHC (benzene hexachloride containing 10 per cent. γ isomer) were exposed outdoors or subjected to controlled leaching in the laboratory. Residual insecticide was estimated at intervals by a method involving dehydrohalogenation, and determinations were also made of chloride content of soil, chloride leached and pH.

Results showed that both DDT and BHC were very stable in the soils, about 95 per cent. of the former and 80 per cent. of the latter being recoverable after 18 months. Very little chloride was leached during this period. The residual insecticide exhibited marked toxicity towards woodlice. Eighteen months after treatment, the BHC soils prevented root growth of germinating seeds, while germination and early growth were normal in the DDT soils. This harmful effect of BHC was still apparent when one part of the treated soils was mixed with 99 parts of the control soil (representing a concentration of less than 0·002 per cent. γ isomer).

LORD (K. A.). **The Contact Toxicity of a Number of D.D.T. Analogues and of four Isomers of Benzene Hexachloride to** *Macrosiphoniella sanborni* **and** *Oryzaephilus surinamensis.*—*Ann. appl. Biol.* **35** no. 4 pp. 505–526, 7 figs., 40 refs. London, 1948.

The following is largely the author's summary. Twenty-three analogues of DDT and the α, β, γ and δ isomers of BHC (benzene hexachloride) were compared with DDT for toxicity as contact insecticides using a direct spraying technique. Each was tested as an emulsified solution in benzene against adults of *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., and *Oryzaephilus surinamensis*, L. The substances tested included a number of halogen and alkyloxy analogues of DDT and a number of compounds of varying degrees of chlorination between diphenylethane and DDT.

The biological data were examined as far as possible by the method of probits. The probit lines for the DDT analogues varied both in position and in slope; those for the BHC isomers in position, but not in slope. In general, neither the relative positions nor the relative slopes of the probit lines for the various substances were the same against the two insect species. The toxicity of substances analogous to DDT appeared to be related to molecular weight, with maximum toxicity occurring in the molecular weight range 300–450. Among DDT analogues, the slope of the probit line was apparently correlated with molecular volume. The variation of the slope of the probit lines is discussed, and it is concluded that it arises from differences in the interaction of the poisons with the test-subjects.

It was not possible to prepare sprays of the α or β isomers of BHC that were sufficiently toxic to obtain a probit regression line with *M. sanborni* or, in the case of the β isomer, to *O. surinamensis*, owing to the slight solubility of these isomers in benzene. The slopes of the probit lines obtained when the different isomers were used against the same insect appeared to be parallel with those given by DDT. The γ isomer was much the most toxic to both species; it was about nine-tenths as toxic as DDT to *M. sanborni* and one-third as toxic to *O. surinamensis*. The relative potencies of the α, γ and δ isomers against *M. sanborni* and *O. surinamensis* were 0 : 16 : 1 and 1·2 : 88 : 1, respectively.

The various theories relating to the toxicity of DDT and BHC [*cf. R.A.E.*, A **35** 203; **37** 16, etc.] are discussed in relation to the experimental data described. To account for all the experimental results by means of one theory, it is necessary to postulate a physico-chemical mechanism of toxic action. Such a mechanism implies that the intensity of biological action will be dependent upon the physico-chemical properties of the poisons, whether or not a specific molecular configuration is involved, and toxicity is therefore dependent on the molecule as a whole.

STRINGER (A.). **Relation between Bioassay Systems and the Values found for Toxicity of D.D.T.**—*Ann. appl. Biol.* **35** no. 4 pp. 527–531, 4 refs. London, 1948.

The following is largely the author's summary. The toxicities of various DDT suspensions tested by McIntosh on *Tribolium castaneum*, Hbst. [*R.A.E.*, A **37** 263] are shown to be equivalent when compared on a weight basis. The relation $w = K\lambda^f$, connecting weight retained by the insect (w) and concentration (λ), is in better agreement with the data than McIntosh's $w = F\lambda$.

When the dosage is expressed as a concentration, the slope of the regression line depends on the method of testing and is a measure of the sensitivity of the system used. This variation in sensitivity was demonstrated in experiments with *Calandra granaria*, L., in which the availability of the DDT was of the same order when the insects were immersed in colloidal suspension or placed in contact with crystalline deposits, and about three times as great when they were placed in contact with a film derived from an oil solution of DDT. The tests also indicated that the rate of diffusion through the insect cuticle was the same for the three methods.

FERGUSON (J.) & PIRIE (H.). **The Toxicity of Vapours to the Grain Weevil.**—*Ann. appl. Biol.* **35** no. 4 pp. 532–550, 3 figs., 21 refs. London, 1948.

The following is based on the authors' summary. The values for concentrations in air of the vapours of nearly 100 chemical substances required to produce 50 per cent. mortality of adults of *Calandra granaria*, L., exposed to them for five hours were determined. Relationships between the chemical constitution of these substances and their toxicity to *C. granaria* are discussed, the measure of toxicity used being the relative saturation of the vapour concentration producing 50 per cent. kill. The relative saturation is equal to the thermodynamic activity of the vapour at the concentration in question, and the value for 50 per cent. mortality is referred to as the toxic thermodynamic activity.

It was found that the substances used can be divided into two broad classes, one in which the toxic thermodynamic activities lie between 0·1 and 1 and another in which they are much lower and range down to 0·0004. The members of the first class, which were the more numerous, exhibit certain linear relationships between the logarithms of toxic concentration and saturated vapour pressure, which are not shown by the second class. They are thought to act as whole molecules, and their toxicity is ascribed to a physical mechanism, and is believed to be such that phase equilibrium relations play a predominant part in determining the value of the toxic concentration measured externally to the insect. The toxicity of members of the second or "chemically toxic" class is thought to be due to their having undergone reactions in, if not with, the body of the insect.

The toxicities of members of the first class, as measured by their toxic thermodynamic activities, show the following relations with chemical constitution: toxicity in homologous series decreases steadily from the first member as the chain length increases, finally disappearing; halogen substitution in hydrocarbon skeletons has only a small effect on the "physical" toxicity, increasing it slightly; there is practically no difference in the effect of different halogens; hydroxyl substitution markedly decreases "physical" toxicity; and the substitution of —CO or —CHO groups markedly increases "physical" toxicity.

The aliphatic amines, the alkyl formates and many of the alkyl bromides and iodides examined do not appear to act by a physical mechanism, and are classed as "chemically" toxic.

BROADBENT (L.). **Methods of recording Aphid Populations for Use in Research on Potato Virus Diseases.**—*Ann. appl. Biol.* **35** no. 4 pp. 551–566, 8 figs., 26 refs. London, 1948.

Methods of counting Aphids infesting potato crops are reviewed and discussed. The results of a survey principally of *Myzus persicae*, Sulz., in different parts of England during 1946 and of counts at Rothamsted during 1947 are given and used to illustrate methods of expressing the counts; the extent of virus spread in 1946 showed no close correlation with the numbers of *M. persicae.* It is concluded that an estimate of the number of Aphids per plant is better for virus disease research than the number per 100 leaves. The number of *M. persicae* per plant can be estimated with tolerable accuracy as the sum of figures obtained by multiplying the mean numbers per leaf in the upper, middle and lower part of the plant (obtained by counting the Aphids on one upper, one middle and one lower leaf from each of 40 plants selected at random) and the mean number of leaves in the corresponding category per plant (estimated from the total number in each category on every alternate plant of the 40 selected). For most surveys in Britain, where infestation is always relatively low, a method that does not necessitate counting the Aphids might be adequate. In tests at Rothamsted in 1946 and 1947, when the upper, lower and middle leaf from 33 plants per field were taken and each group of three leaves regarded as a sampling unit, it was found that the maximum population of *Myzus persicae* per plant could be obtained by adding 10 to the percentage figure for infestations of such units up to 60 per cent., and that for infestations of 70, 80, 90 and 100 per cent., maximum populations were 200, 400, 700 and 2,000 per plant, respectively.

ANSCOMBE (F. J.). **On estimating the Population of Aphids in a Potato Field.**—*Ann. appl. Biol.* **35** no. 4 pp. 567–571, 4 refs. London, 1948.

The following is from the author's summary. This appendix to a paper by L. Broadbent [see preceding abstract] deals with the statistical problem of estimating the population of Aphids per plant in a field of growing potatoes. An unbiased method is described, in which a definite proportion of a number of plants is sampled, and also a more rapid method of stratified sampling. Sampling for purposes of inspection is then considered, using practices current in industrial statistics. Finally some counts on *Myzus persicae*, Sulz., are examined, to obtain information on the type of variation in Aphid numbers to be expected.

DALE (W. T.). **Observations on a Virus Disease of certain Crucifers in Trinidad.**—*Ann. appl. Biol.* **35** no. 4 pp. 598–604, 1 pl., 19 refs. London, 1948.

The following is largely from the author's summary. A virus disease of Indian mustard (*Brassica juncea*), pak-choi (*B. chinensis*) and a variety of radish known as moorei (presumably *Raphanus sativus* var. *hortensis*) occurs in Trinidad, but is not serious. Rape, turnip, and the wild *Lepidium virginicum* were found to be susceptible, but cabbage, cauliflower, kohlrabi and the European radish (*R. sativus* var. *radicula*) seemed to be immune. *Zinnia elegans* and tobacco were infected by mechanical inoculation, but no infections were obtained in six other species of *Nicotiana*, beet, Swiss chard or cowpea. Tobacco showed only necrotic local lesions, whereas the other hosts showed no local lesions, but a systemic mottling, usually accompanied in crucifers by leaf deformation and stunting of the plant.

The virus was transmitted by mechanical inoculation and also by *Rhopalosiphum pseudobrassicae*, Davis, which is probably responsible for spread in the field ; crucifers that were not infected by the former were also resistant to the latter. This Aphid increased rapidly on all cruciferous crops in the greenhouse, where it was difficult to control and rendered the use of insect-proof cages necessary. In the field, it is common on mustard, pak-choi and moorei, especially on plants in seed, on which both alates and apterae occur. The virus is probably of the non-persistent type [*cf.* *R.A.E.*, A **29** 26] ; it remained infective for three days *in vitro*, but Aphids ceased to be infective less than 24 hours after they had fed on diseased plants. The properties and hosts of this virus are compared with those of others affecting crucifers. It has affinities with some of them, but is considered to be distinct.

BARBER (H. S.). *Diabrotica* **and two new Genera (Coleoptera, Chrysomelidae).**—*Proc. ent. Soc. Wash.* **49** no. 6 pp. 151–161, 10 figs. Washington, D.C., 1947.

The two new genera erected include several species previously referred to *Diabrotica*. The species retained in *Diabrotica*, of which *Crioceris fucata*, F., is designated as the type, include *undecimpunctata*, Mannh., *balteata*, Lec., *longicornis*, Say, *atripennis*, Say, and *lemniscata*, Lec. A key is given to the North American subspecies of *D. undecimpunctata* known as twelve-spotted cucumber beetles, showing their distribution ; they are *undecimpunctata* (Pacific Coast States [*cf.* *R.A.E.*, A **30** 357]), *duodecimnotata*, Harold (Mexico), *howardi*, subsp. n. (Eastern and Southern States) and *tenella*, Lec. (Arizona). *D. u. howardi* is the common pest that has been known as *D. duodecimpunctata* on the assumption that it is identical with the beetle described by Fabricius as *Chrysomela duodecimpunctata*, but this name is preoccupied by *Crioceris* (*Chrysomela*) *duodecimpunctata*, L. *D. mauliki*, n.n., is proposed for *D. undecimpunctata*, Jac. (nec Mannh.), of which the type locality is Peru.

The two new genera are *Amphelasma*, which includes *cavum*, Say (the type), *decoratum*, Jac., and *unilineatum*, Jac., from Mexico, *bipuncticolle*, Schaeff., from Arizona, and *trilineatum*, Jac., from Guatemala ; and *Acalymma*, of which the type is *A. gouldi*, sp. n., described from squash and cucumber in Indiana and also found in Quebec, and which also includes *D. vittata*, F., *D. trivittata*, Mannh., *D. blandula*, Lec., and *D. vincta*, Lec., which occur in the United States, the Mexican species, *D. pallipes*, Ol. (*theimei*, Baly), and numerous tropical species. *A. vittata* is the species that has been called *D. melanocephala*, F., on the authority of Lever [**18** 693], but the author concludes that changes by Fabricius in the application of names given by him to a number of species invalidate the synonymy adopted by Lever and also preclude the use of *vittata*, F. (1801) for a species of *Phyllotreta*. The synonymy of the species that come into consideration, Fabricius being the author of all of them, is as follows: *Acalymma vittata* (*Cistela melanocephala, Crioceris vittata*); *Synodita melanocephala* (*Crioceris melanocephala*); *Diabrotica capitata* (*Galleruca melanocephala, Crioceris capitata, Crioceris tripunctata*); *Phyllotreta striolata* (*Crioceris* (saltatoriae) *vittata*).

Van Leeuwen (E. R.). **Attractiveness of Pine-tar Oil in Baits for Codling Moth Control.**—*J. econ. Ent.* **41** no. 3 pp. 345–351, 2 refs. Menasha, Wis., 1948.

The results are given of tests of pine-tar oil in baits for adults of *Cydia* (*Carpocapsa*) *pomonella*, L., made in apple orchards near Yakima, Washington, in 1934–38 [*cf. R.A.E.*, A **32** 48]. The bait pans used had a diameter of 7 ins. and held 1 U.S. quart. An emulsion of 20 ml. pine-tar oil and 5 gm. saponin in 80 ml. water, diluted to contain 1·5–15 ml. pine-tar oil per U.S. quart water and mixtures of 1·5–30 ml. pine-tar oil and 1 U.S. quart highly refined white oil caught fewer moths than a standard bait of molasses and water (1 : 10) containing one cake of yeast per 10 U.S. gals., but the effectiveness of the standard bait was increased by the addition of pine-tar oil, either emulsified in it or in a vial with a surface area of 1·3 sq. cm. floating on it. In a subsequent experiment the standard bait with a vial of pine-tar oil caught 43 per cent. more moths than the standard bait containing emulsified pine-tar oil. During two periods of test in which the total number of moths caught by a standard bait was 900, the numbers caught in a pan of water on which a vial of pine-tar oil was floating were 1,226 when the pan was near the standard bait and 390 when it was at a distance, as compared with 70 caught in a pan of water. The pine-tar oil was therefore definitely attractive in itself, but caught many more moths when near the standard bait. To compare the attractiveness in a given area of the standard bait with and without a vial of oil floating on it, nine traps of each bait were used in two widely separated blocks of trees within an orchard, the traps in each being alternated every other day for 21 days. A total of 2,063 moths was taken by the bait with oil and 760 by that without, which indicated that all the moths would not have been caught by the standard bait if the more attractive one had been absent. When a dispenser with five wicks was hung 4 ft. above a standard bait to determine whether the odour from a large volume of pine-tar oil would attract many moths, its use increased the catch by the standard bait by 59·5 per cent. To compensate for the evaporation that takes place in a liquid bait on exposure, 0·125–0·5 ml. pine-tar oil emulsion was added twice a week to a standard bait that originally contained 0·5 ml. per U.S. quart, and 0·375–0·75 ml. to one that contained 0·75 ml. All baits containing additional oil caught more moths than those that did not, but in the second case, some of the supplemented baits evidently contained too much oil and caught fewer than those containing less. Comparison of vials with surface areas of 0·4–25·8 sq. cm. for floating pine-tar oil on the standard bait showed that the most effective area was 1·3 cm., which increased the catch by 105 per cent.

Each of eight fractions of pine-tar oil was attractive, and three were more attractive than the oil from which fractions were made. Experiments with combination baits in which 0·5–3 ml. each of valeric acid and nicotine sulphate was added to the standard bait used in conjunction with pine-tar oil in a 1 oz. bottle dispenser showed that all additions were better than none and the best was 0·5 ml. valeric acid and 1 ml. nicotine sulphate. In a further test in which 0·5 ml. valeric acid and 1 ml. nicotine sulphate were tested separately in the standard bait, with 1 oz. pine-tar oil in the bottle, the valeric acid apparently did not add materially to the efficiency of the mixture.

The baits were tested as a supplementary control measure in orchards in 1935–38. There was a gradual decrease in the numbers of moths caught by the baits from the outside of a baited plot to the centre, indicating that many moths drifted or migrated from unbaited trees to the baited areas. Fruit infestation in baited and unbaited areas showed little difference, and it is concluded that the method has no value for supplementary control.

CARRUTH (L. A.) & HOWE (W. L.). **Factors affecting Use and Phytotoxicity of DDT and other Insecticides for Squash Borer Control.**—*J. econ. Ent.* **41** no. 3 pp. 352–355, 2 figs., 2 refs. Menasha, Wis., 1948.

The following is substantially the authors' summary. In experiments at Geneva, New York, in 1947 on the control of *Melittia cucurbitae*, Harr., on squash, observations were made on the susceptibility to infestation of Blue Hubbard, Table Queen and Butternut squash (*Cucurbita maxima*, *C. pepo* and *C. moschata*), the effectiveness of insecticides and insecticide phytotoxicity [*cf.* *R.A.E.*, A **37** 250]. The percentages of untreated plants of the three species that were infested were 40, 12·7 and 0, respectively, the absence of infestation in Butternut squash being possibly due to its small, compact woody stem, which is not well adapted to the usual feeding habit of the larvae. Effective control of the borer was obtained with dusts containing 1 per cent. rotenone as cubé, 3 per cent. DDT (setting point 103–105°C.), 5 per cent. chlordan or 1 or 2 per cent. parathion, but 10 per cent. sabadilla and 3 per cent. bis(methoxyphenyl)trichlorethane [methoxy-DDT] were less effective. Although 3 per cent. DDT (setting point 90°C.), 1 per cent. γ benzene hexachloride and 2 per cent. toxaphene were effective against the borers, they all caused serious injury to the plants.

Striking differences in phytotoxicity were observed between the dusts containing the two grades of DDT. The one with the lower setting point (technical DDT) produced chlorosis, dwarfing and necrosis of the foliage of Table Queen squash, and killed practically all the plants, and produced foliage chlorosis of Butternut squash and killed over half the plants, but was less injurious to Blue Hubbard, although it reduced the yield. No phytotoxic symptoms were caused by dusts prepared from DDT with the higher setting point. Dusts containing chlordan and parathion resulted in characteristic foliage injury in some cases, but these were later outgrown and did not appear to effect the yield.

HOFFMAN (J. R.). **Hexaethyl Tetraphosphate and Tetraethyl Pyrophosphate as Aerosols against the Two-spotted Spider Mite.**—*J. econ. Ent.* **41** no. 3 pp. 356–362, 3 figs. Menasha, Wis., 1948.

The author describes laboratory tests in New York of the fumigant action of HETP (hexaethyl tetraphosphate) on *Macrosiphum solanifolii*, Ashm., which showed that the pure material had a high fumigant effect, but that the addition of water resulted in hydrolysis, which greatly reduced the toxicity of the vapour. The toxicity curve obtained from the mixtures of HETP with water rose for six hours after they were made and then fell, indicating that hydrolysis aids in the volatilisation of the TEPP (tetraethyl pyrophosphate), which is considered to be the active ingredient of HETP [*cf.* *R.A.E.*, A **37** 214], or that some other volatile toxic product of hydrolysis is evolved before the complete hydrolysis of the HETP into non-toxic components.

Both HETP and TEPP were tested as aerosols against *Tetranychus bimaculatus*, Harvey, on potted rose plants in the greenhouse. They were almost insoluble in Freon 12 [dichlordifluoromethane], but completely soluble in methyl chloride, and 20 per cent. solutions in methyl chloride were tested at dosages of 1–11 gm. HETP or TEPP per 1,000 cu. ft. space, while lower dosages (0·125–0·5 gm. per 1,000 cu. ft.) were applied in 5 ml. methyl chloride, as the dispenser could not be used with smaller amounts. Counts of surviving mites were made 24 hours after treatment to find the actual toxicity of the aerosol to the active stages and three and seven days after to find the increase of infestation on the treated plants. All treatments were made by the complete dispersal at a temperature of about 70°F. of a measured amount of freshly prepared aerosol solution, and the plants were exposed for six hours. No significant difference was noted between tests at high and low relative humidities. The results obtained indicated that the optimum dosage of both materials is about 3 gm. per 1,000 cu. ft., provided that the plants used are not injured by it. At this dosage, TEPP caused no more injury to the plants than HETP, and the percentages of mites killed after 24 hours and seven days were 93·5 and 48·6 for the former and 84·9 and 37 for the latter. The kills were estimated by Abbott's formula [**13** 331], using mites exposed to methyl chloride (75 ml. per 1,000 cu. ft.) as controls; 96·2 and 95·3 per cent. of these were alive after 24 hours and seven days. When mortality was plotted against dosage, TEPP was shown to be about three times as toxic as HETP over the whole range and the curves obtained for the two materials were almost parallel, which supports the opinion that TEPP is the toxic ingredient of HETP and that HETP is a mixture of phosphates of various kinds. The median lethal dosages were 0·25 gm. HETP and 0·08 gm. TEPP per 1,000 cu. ft.; the TEPP used was later found to contain 25 per cent. pure compound.

Crowell (H. H.), Morrison (H. E.), Crumb jr. (S. E.) & Lauderdale (R. W.). **Cabbage Maggot Control by the Use of Benzene Hexachloride in the Soil.**—*J. econ. Ent.* **41** no. 3 pp. 362–365, 8 refs. Menasha, Wis., 1948.

The following is based on the authors' summary. The incorporation into the soil before sowing of 27·5 lb. γ BHC (benzene hexachloride) per acre in the form of technical BHC containing 10 per cent. γ isomer, gave practically complete control of *Hylemyia brassicae*, Bch., on radish, kohlrabi, broccoli, mustard and swedes, throughout the growing season of 1947 at Corvallis, Oregon. The dust was applied on 18th May to the surface of the soil, which was then thoroughly cultivated with a rotary tiller to a depth of 7–8 inches, and was estimated to be present at the rate of 1·01 lb. γ BHC per 1,000 cu. ft. Similar treatment with 50 per cent. wettable DDD or DDT at 106·8 and 137·5 b. toxicant per acre, 30 per cent. hydroxypentamethylflavan, at 38·4 lb. toxicant per acre or 5 per cent. chlordan or chlorinated camphene [toxaphene] at 27·5 lb. toxicant per acre, and the application of 288 lb. propylene dichloride per acre with a power soil injector gave no control. The incorporation of BHC into the soil at rates of up to 3·305 lb. γ isomer per 1,000 cu. ft. by working t into the top 1–2 inches of soil with a garden rake gave fair protection to adishes for 39 days, but not longer, though many radishes showed maggot njury only in the tap root below the edible bulb and below the level of the soil containing BHC. The mustard grown in soil that was treated with BHC by tilling matured earlier and gave a substantially higher yield of seed than that grown in untreated soil and soil similarly treated with DDT or chlordan. The importance of deep thorough mixing of the toxicant with the soil for the ontrol of *M. brassicae* is evident. Although BHC showed decided promise for ts control when efficiently mixed with the soil, its toxicity to certain plants nd its ability to flavour others are disadvantages that may limit its use. It also gave a high degree of control of *Scutigerella immaculata*, Newp., Collembola nd larvae of the western spotted cucumber beetle [*Diabrotica undecimpunctata*, Mannh.] when tilled into the soil in preliminary tests.

Morrison (H. E.), Crowell (H. H.), Crumb jr. (S. E.) & Lauderdale (R. W.). **The Effects of certain new Soil Insecticides on Plants.**—*J. econ. Ent.* **41** no. 3 pp. 374–378, 11 refs. Menasha, Wis., 1948.

Plots of cove clay at Corvallis, Oregon, that had been manured heavily in he spring of 1947 and tilled twice with a rotary tiller on 4th May were treated with propylene dichloride on 5th May or with dusts containing DDD, DDT, hydroxypentamethylflavan, γ BHC (benzene hexachloride), chlordan or chlorinated camphene [toxaphene] on 18th May and tilled again on the last date to a depth of 7–8 inches [see preceding abstract]. A total of 29 different vegetables were grown in the soil, chiefly from seed sown on 20th May, though additional tomatos, lettuce, peppers [*Capsicum*] and egg-plant [*Solanum melongena*] were transplanted. A similar experiment was carried out on a fine sandy loam at Eugene, Oregon, in which 10 lb. chlordan, 1,1-x-chlordiphenyl ethane, toxaphene, dichlordiphenylethane or γ BHC per acre were applied on 15th May and tilled to a depth of 3–4 inches.

Observations made throughout the summer showed that propylene dichloride, DDD, hydroxypentamethylflavan and toxaphene caused no plant injury, chlordan produced slight stunting and chlorosis of lima beans at Corvallis, DDT caused severe stunting of beans and slight stunting and reduction of the size of leaves and fruit of tomato, and BHC caused no injury at Eugene, but at Corvallis, where it was used at a higher rate, destroyed beet, cucurbits, chard, maize, onion, pea, peppers grown from seed, potato, spinach and tomato grown from seed, caused some injury to lima, bush and pole beans, endive, lettuce and transplanted pepper and tomato, and was harmless to broccoli, cabbage, carrot, celery transplants, kohlrabi, mustard, parsnip, radish and swedes. The crucifers showed an increase in vigour in the BHC plots, but it was not known whether this was directly due to plant response or indirectly to pest control. Egg-plant was not planted in the BHC plot. No flavouring of BHC could be detected in cabbage, broccoli, kohlrabi, mustard, celery, carrot, lettuce, endive, tomato, peppers, parsnip or lima, bush or pole beans. The few potato tubers produced in soil treated with it and those of plants dusted with it developed a definite flavour, as did cobs from the one maize plant that survived in the plot treated with BHC and those from dusted plants. Soil treatment with BHC controlled weeds such as *Chenopodium album*, *Amarantus retroflexus* and *Convolvulus arvensis* for over five months, but had no apparent effect on grasses or *Senecio vulgaris*. It is concluded that injury to plants by BHC may be associated with soil type, soil minerals, acidity or other factors, and that much additional information is needed before it can be accepted for pest control without strict regulation of crop rotation.

SUN (Yun-Pei), NORTON (L. B.) & RAWLINS (W. A.). **Comparison of toxic Actions of Chlordan, DDT, and Gamma-Benzene Hexachloride to the Southern Armyworm.**—*J. econ. Ent.* **41** no. 3 pp. 366–369, 2 figs., 9 refs. Menasha, Wis., 1948.

The authors describe investigations in which chlordan, DDT and γ BHC (benzene hexachloride) were compared as fumigants, contact poisons and stomach poisons against larvae of *Laphygma* (*Prodenia*) *eridania*, Cram. To test the fumigant effect, 10 gm. of each material was spread over a large petri dish in a desiccator and a smaller dish containing ten larvae of equal size and a piece of potato for food was kept over it for two days, so that the larvae were in an atmosphere saturated with toxic vapour. Mortality of medium-sized larvae (weighing 100 mg.) was very low for all three compounds, but chlordan gave 96·3 per cent. mortality of small larvae (12 mg.), whereas γ BHC and DDT gave only 35 and 15 per cent., respectively.

Contact action was tested by dusting the larvae with pyrophyllite impregnated with an acetone solution of the insecticide and transferring them to clean dishes and undusted food. The apparatus used is described ; it was devised to ensure that the dust falling on the insects would be of the same composition as the original dust. The amount deposited was adjusted to an average of 0·53 mg. per sq. cm. Dusts containing 1 per cent. chlordan, DDT or γ BHC were very effective against medium-sized larvae, but one containing 1 per cent. nicotine alkaloid was not. However, the DDT and γ BHC dusts were more effective against large larvae (700 mg.) than the chlordan dust (40, 32 and 2 per cent. mortality after two days).

To test the stomach action, leaf sandwiches containing the pure insecticides applied from concentrated acetone solutions by a method described, were offered to the larvae, which were kept in separate dishes for four days at temperatures of 24–25° C. [75·2–77°F.]. Larvae in the last instar fed readily on sandwiches containing chlordan, DDT or BHC, but about half refused to finish sandwiches containing lead arsenate. Plotting the results on logarithm-probit graphs showed that the median lethal doses in mg. per gm. body weight were 0·031 for γ BHC, 0·06 for DDT, 0·13 for chlordan and 0·29 for lead arsenate.

ASHDOWN (D.) & WATKINS (T. C.). **Field Studies on Control of Onion Thrips in New York.**—*J. econ. Ent.* **41** no. 3 pp. 378–382, 8 refs. Menasha, Wis., 1948.

The following is based on the authors' summary. A programme for the control of *Thrips tabaci*, Lind., on muck-grown onions in New York was developed in numerous field tests in which the timing of schedules and inclusion of various concentrations and forms of DDT were investigated. Details of these tests are not given in this paper, but the best programme is one in which a 5 per cent. DDT dust is employed in paired applications of 35 lb. per acre, beginning when the thrips population reaches an average of about six per plant. The second application is made after an interval of 5–6 days, to allow for hatching of eggs and redistribution of any thrips that were protected by leaf sheaths when the first was applied. Analyses of DDT residues on onion bulbs from crops that had received field applications of more than 5 lb. toxicant per acre in dusts or sprays showed residues of only 0·2 part per million or less, indicating that there is hardly any hazard in the use of DDT on bulb onions.

The addition of copper-containing fungicides did not affect the toxicity of DDT dusts to the thrips, and adding 25 or 50 per cent. sulphur to a 5 per cent. DDT dust or increasing the DDT content to 10 per cent. did not improve the control obtained. Aeroplanes and helicopters were both found to be efficient in distributing the dusts.

A dust containing 1·2 per cent. γ BHC (benzene hexachloride) and an aerosol of DDT, cyclohexanone, oil, acetone, pyrethrum and methyl chloride (10 : 5 : 5 : 20 : 3 : 57) were as effective as the 5 per cent. DDT dust in controlling the thrips and resulted in equally high yields. BHC cannot yet be recommended, on account of the risk of tainting, but the aerosol, although expensive, may be useful on muck-grown crops, where light-weight equipment is a particular advantage, if the content of DDT or pyrethrum can be reduced without loss of insecticidal efficiency.

EDEN (W. G.) & ARANT (F. S.). **DDT Residues on Alfalfa.**—*J. econ. Ent.* **41** no. 3 pp. 383–387, 18 refs. Menasha, Wis., 1948.

The authors discuss the toxicity of DDT to warm-blooded animals from the literature and describe experiments carried out in Alabama in the autumn of 1946 to determine the residues present on lucerne dusted with DDT under wet and dry conditions. Plots of second-year lucerne were dusted under a frame with 3 per cent. DDT in pyrophyllite 1–3 times at intervals of 10 days at rates of 15 or 30 lb. per acre, one half of each plot being thoroughly wet immediately before treatment. In general, the residues increased with the amount of DDT applied. On dried samples taken immediately after the first and third applications to wet plants they were 132 and 162 parts DDT per million for 30 lb. dust per acre and 40 and 99 for 15 lb. Similar trends occurred on foliage dusted when dry, so that as little DDT should be applied as is consistent with adequate insect control, particularly if the crop is to be harvested soon after. The residues were greater when the foliage was dusted while wet, but the rate of weathering was also greater. The residues on hay harvested immediately after 1–3 applications at 30 lb. per acre averaged 147 and 117 p.p.m., respectively, for plants treated wet and dry, whereas after weathering for 40 days they averaged 38 and 36 p.p.m. Similar results were noted on lucerne dusted at 15 lb. per acre. A larger proportion of the total DDT applied was recovered as residue immediately after one application than after two or three (24·3, 13·5 and 9·9 per cent. after one, two and three applications of 30 lb. to wet foliage), and the same was true, with smaller differences, after 40 days of weathering. The residues decreased over 40 days and tended to become equal on all plots receiving DDT at the same rate, whatever the number of applications. The greatest decrease occurred during the first ten days, probably as a result of shattering, rainfall or other mechanical processes, that during the next 30 days being probably due to decomposition. DDT was still present in significant amounts on all foliage 40 days after dusting, the lowest residue (10 p.p.m.) occurring on lucerne dusted once at 15 lb. per acre. When the rate was 30 lb. per acre, 30–40 p.p.m. remained after 40 days, but the data indicate that 40 days approached the time limit for persistence of DDT exposed to general weathering. Hay bearing these amounts could probably be fed to dairy cattle for several months with safety.

KULASH (W. M.). **New Insecticides for Corn Earworm Control.**—*J. econ. Ent.* **41** no. 3 pp. 387–389, 5 refs. Menasha, Wis., 1948.

Experiments were carried out in North Carolina in the summer of 1947 to test new insecticides as sprays and dusts for protecting the ears of sweet maize from *Heliothis armigera*, Hb. They were compared with white mineral oil (310 Saybolt) containing 0·25 per cent. DDT applied with a hand oiler at the rate of 1 cc. per ear when the silks began to dry. Dusts containing 5 per cent. chlordan, chlorinated camphene [toxaphene], DDT, γ BHC (benzene hexachloride) and bis(methoxyphenyl)trichlorethane [methoxy-DDT], and two commercial *Ryania* dusts, containing 40 per cent. ground wood or its equivalent as an extract, were applied directly to the silks with a hand duster ; and sprays containing 0·25 per cent. *Ryania*, DDT (water-miscible), parathion or DDD (wettable) were applied to the tips of the ears with a small sprayer having a jet-type nozzle that delivered a stream of liquid into the centre of the silk channel, each ear receiving about 5 cc. The dusts were applied five times at intervals of two days from the time when the silks were 2–3 inches long, and the sprays, except parathion, which was applied only three times, four times at intervals of three days.

Two hybrids, MC78 and C81 × C88, were treated, and the highest proportion of uninfested ears in each was given by the oil treatment (82·5 and 75·5 per cent.). Plants of MC78 sprayed with DDD, DDT and *Ryania* and dusted with *Ryania* (extract) and BHC had 77·2, 69·2, 61·3, 54·8 and 46·4 per cent. uninfested ears, whereas those receiving the other treatments or none had less than 40 per cent., and plants of C81 × C88 treated with DDT and *Ryania* sprays and DDT, BHC, *Ryania* (extract) and chlordan dusts had 59·3, 51·2, 61·2, 51·9, 43·2 and 40·4 per cent. clean ears and the remainder less than 35 per cent. The only treatments that affected the flavour of the ears were DDT in oil and the BHC dust, except that one of 70 ears treated with DDD was reported to be tainted.

GRIFFITHS jr. (J. T.) & KING (J. R.). **Comparative Compatibility and Residual Toxicity of organic Insecticides as based on Grasshopper Control.**—*J. econ. Ent.* **41** no. 3 pp. 389–392, 6 refs. Menasha, Wis., 1948.

The following is based on the authors' summary. The results are given of observations and cage tests on the toxicity of spray and dust residues of chlordan, chlorinated camphene [toxaphene], BHC (benzene hexachloride) and parathion to *Schistocerca americana*, Drury, in *Citrus* groves in Florida and on the compatibility of these insecticides with other spray ingredients. BHC at 0·45 lb. γ isomer per acre, and parathion at 0·45 lb. per acre had lost nearly all their toxicity after three days, whereas chlordan at 1·5 lb. and toxaphene at 4·5 lb. showed some toxicity for more than a week. Dusts were as satisfactory as sprays in wet weather, but less so in dry, and in dry weather, wettable materials were generally inferior to emulsifiable materials or wettable powders in oil emulsions. All four insecticides were found to be compatible with wettable sulphur (10 lb. per 100 U.S. gals.), 40 per cent. dinitro-o-cyclohexylphenol (0·67 lb.), neutral copper (3 lb. 34 per cent. metallic copper) and zinc sulphate (3 lb. zinc sulphate and 1 lb. lime). All such combinations gave comparable mortalities.

HILL (R. E.), HIXSON (E.) & MUMA (M. H.). **Corn Rootworm Control Tests with Benzene Hexachloride, DDT, Nitrogen Fertilizers and Crop Rotations.** —*J. econ. Ent.* **41** no. 3 pp. 392–401, 3 figs., 28 refs. Menasha, Wis., 1948.

The following is based on the authors' introduction and summary. The northern, western and southern corn rootworms (*Diabrotica longicornis*, Say, *D. virgifera*, Lec., and *D. undecimpunctata howardi*, Barber) have in recent years increased to extremely large numbers on maize in Nebraska, owing to temperature and rainfall favourable for their development over a series of years and the continuous growing of maize on the same land [*cf. R.A.E.*, A **35** 362]; losses have been greatest in maize grown on irrigated soil. Crop rotation has usually given effective control of the first two, and timely planting, clean cultivation, the destruction of weeds in field margins and the alternate growing of leguminous plants has reduced the injury caused by the last. The field experiments described were carried out in 1946 and 1947 in an attempt to develop supplementary control measures. All three species were present, but *D. virgifera* was much the most abundant and *D. u. howardi* was rare.

The results obtained showed that injury by both *D. virgifera* and *D. longicornis*, as evidenced by stalk lodging, was greatly reduced in irrigated fields when maize was grown in rotation following sweet clover [*Melilotus*] or treated with nitrogenous fertilisers, and that the use of such a fertiliser, manure or a leguminous crop in the rotation system greatly increased yields. Nitrogen did not appear to affect rootworm populations, but hastened root recovery; phosphorus had no effect on yield or lodging.

Soil applications of BHC (benzene hexachloride) sprayed as a suspension on the surface one day before ploughing (about a week before sowing) at rates of 0·5, 1 or 2 lb. γ isomer per acre, or applied in dusts as side-dressings just before the first cultivation at 0·8, 1·6 or 2·4 lb., greatly reduced the numbers of larvae in irrigated fields and almost eliminated root injury and lodging. Technical DDT applied by the same methods at rates of 5 or 10 lb. per acre was little or no better than no treatment. Yields were not significantly increased by any of the insecticide treatments, but when corrections were made to eliminate ears produced on stalks lodged 60° or more, which would ordinarily be missed by mechanical pickers, all the plots treated with BHC as side-dressings were shown to have produced significantly higher yields than others.

Under dry-land conditions, stalk damage, indicated by lodging and root loss, was significantly greater in plots in which maize followed maize than where it followed wheat, but maize following maize on soil sprayed before the first cultivation with 1 lb. γ BHC per acre had significantly less stalk lodging, although yields did not differ.

Applications by aeroplane in August of 3 per cent. DDT dusts at the rate of 25–30 lb. per acre against adults of *D. virgifera* and *D. longicornis* gave excellent kills. Field observations indicated that such treatments reduced populations so effectively that lodging was of little consequence during the following season.

The data obtained in the experiments described or given in the literature do not suggest that control of rootworms would increase yields, and every measurable yield increase so far reported could have been due to the addition of some plant nutrient, especially nitrogen, to the soil. It appears that available nitrogen in the soil is necessary for large maize yields and root recovery, and that rootworm injury, as such, may be a minor factor in reducing yields. Nevertheless, the difficulty and losses experienced in harvesting ears from lodged and fallen stalks are serious and can be materially reduced, if not eliminated, by suitable treatments.

YOUNG (M. T.). **Control of Boll Weevil and Cotton Aphid with Benzene Hexachloride and Chlorinated Camphene in 1947.**—*J. econ. Ent.* **41** no. 3 pp. 401–403. Menasha, Wis., 1948.

Further field-plot tests of dusts containing organic insecticides in programmes for the control of *Anthonomus grandis*, Boh., and *Aphis gossypii*, Glov., on cotton [*cf. R.A.E.*, A **37** 194] were made in Louisiana in 1947, and their effect on infestation by *Tetranychus bimaculatus*, Harvey, was also observed. Treatments were begun when about 25 per cent. of the squares were infested by the weevil, and applications were made six times at intervals of 4–5 days and, in the case of BHC (benzene hexachloride) and chlorinated camphene [toxaphene], four times at intervals of 7–9 days.

The percentage of squares infested by the weevil and the numbers of the Aphid and the mite per sq. inch of leaf averaged 49, 1·36 and 3·1 for no treatment, 30, 5·18 and 1·9 for calcium arsenate, 30, 0·54 and 1·5 for calcium arsenate with the addition in alternate applications of 2 per cent. nicotine, 27, 1·29 and 2 for calcium arsenate with the substitution of 5 per cent. γ BHC in one of the first four applications, 30, 2·68 and 2·1 for calcium arsenate with the substitution of 20 per cent. toxaphene in the first, second or fourth application, 41–29, 0·55–0·07 and 3·8–6 and 36–24, 0·15–0·06 and 7–7·6 for four and six applications, respectively, of 1·25–5 per cent. γ BHC, and 47–39, 0·88–0·43 and 4–8·3 and 47–32, 0·62–0·21 and 3–3·7 for four and six, respectively, of 5–20 per cent. toxaphene. Whether treatments were applied in the early morning or late afternoon made no difference to BHC, toxaphene or calcium arsenate alone or with nicotine ; the other treatments were made in the early morning. The yield was significantly increased by all the calcium-arsenate treatments and by the highest concentrations of BHC and toxaphene when applied six times, the differences between these not being significant.

SCALES (A. L.) & SMITH (G. L.). **Cage Tests against the Boll Weevil and the Tarnished Plant Bug with synthetic Organic Insecticides and Calcium Arsenate in 1947.**—*J. econ. Ent.* **41** no. 3 pp. 403–405, 1 ref. Menasha, Wis., 1948.

The results are given of three series of cage tests carried out in Louisiana in 1947 with chlordan, BHC (benzene hexachloride), chlorinated camphene [toxaphene], parathion, DDT and methoxy-DDT in dusts applied at 8 lb. per acre against *Anthonomus grandis*, Boh., and *Lygus oblineatus*, Say, on cotton.

In the first, dusts containing 0·5, 1 or 2 per cent. parathion, 5, 10 or 20 per cent. chlordan or toxaphene or 1·25, 2·5 or 5 per cent. γ BHC were applied against *Lygus* between 30th June and 18th July and compared with calcium arsenate against the weevil between 14th July and 25th August. At comparable concentrations (high, low or intermediate), BHC was the most effective against *Lygus*, parathion and toxaphene about equal, and chlordan the least toxic ; the highest concentration of each was significantly better than either of the lower ones. The highest concentrations of chlordan, toxaphene and BHC were as effective as calcium arsenate against the weevil, but lower concentrations were significantly less effective, and parathion was much less effective than any other material tested.

The second series was made against *Lygus* during late July and early August and against the weevil between 5th and 27th August. When the organic compounds were used alone against *Lygus*, 3 per cent. γ BHC and 2·5 per cent. parathion gave high and about equal mortality, 5 per cent. DDT and 10 per cent. toxaphene were rather less effective but equal to each other, and 10 per cent. chlordan was much less so, though significantly better than calcium arsenate. Mixtures of any two of the organic compounds at the concentrations stated were about as effective as the best of the single treatments. Against the weevil, all the organic insecticides except DDT, and all the mixtures of them, were about as effective as calcium arsenate.

The third series was carried out against *Lygus* between 7th and 23rd July and against *Anthonomus* between 15th July and 11th August. Against *Lygus*, mixtures of 3 per cent. γ BHC or 10 per cent. chlordan with 5 per cent. DDT were as effective as 6 per cent. γ BHC alone ; 20 per cent. chlordan alone and 5 per cent. chlordan with 5 per cent. DDT were less effective, 50 per cent. methoxy-DDT still less so, and 5 and 10 per cent. chlordan alone ineffective, possibly owing to their poor dusting qualities. Against the weevil, 20 per cent. chlordan, 10 per cent. chlordan with 5 per cent. DDT, 50 per cent. methoxy-DDT and calcium arsenate were the most effective, with no significant differences between them.

PARENCIA jr. (C. R.) & EWING (K. P.). **Bollworm Control with Chlorinated Camphene, DDT, and Mixtures of Benzene Hexachloride and DDT.**—*J. econ. Ent.* **41** no. 3 pp. 406–409, 4 refs. Menasha, Wis., 1948.

Two small-plot and six large-scale field experiments were carried out at Waco, Texas, in 1947 to compare the effectiveness of different dusts against *Heliothis armigera*, Hb., on cotton [*cf. R.A.E.*, A **37** 196].

In one small-plot test, 20 per cent. chlorinated camphene [toxaphene], a mixture containing 3 per cent. γ BHC (benzene hexachloride), 5 per cent. DDT and 20 per cent. sulphur, 10 per cent. DDT in sulphur or pyrophyllite, and calcium arsenate all significantly reduced injury to bolls by *Heliothis* ; calcium arsenate was the least effective and significantly less effective than any of the other dusts except toxaphene. Infestation by *Aphis gossypii*, Glov., increased significantly on the plots dusted with calcium arsenate and 10 per cent. DDT in pyrophyllite. There were no significant differences in yield. In the second small-plot test, dusts of 10 or 20 per cent. toxaphene with 50 per cent. sulphur, 10 per cent. toxaphene with 5 per cent. DDT and 50 per cent. sulphur, 3 per cent. γ BHC with 5 per cent. DDT and 20 per cent. sulphur, and 5 per cent. DDT with 75 per cent. sulphur reduced the injury to squares significantly with no significant difference between treatments. They all reduced boll injury significantly, 10 per cent. toxaphene with 5 per cent. DDT being significantly more effective than all other treatments except 20 per cent. toxaphene.

The yield was significantly increased by 20 per cent. toxaphene and by DDT with toxaphene or BHC, with no significant differences between them.

In large-scale experiments in which 3–5 applications were made in late July and August, 20 per cent. toxaphene, 5 per cent. DDT with 3 per cent. γ BHC and 10 per cent. DDT gave about equal control of *H. armigera* and were better than calcium arsenate. In some instances, a severe infestation of red spider mite [*Tetranychus*] followed the use of toxaphene in an inert diluent, but this was prevented by including at least 50 per cent. sulphur in the dust.

GAINES (J. C.) & WIPPRECHT (R.). **Effect of Dusting Schedules on the Yield of Cotton during 1947.**—*J. econ. Ent.* **41** no. 3 pp. 410–412, 1 ref. Menasha, Wis., 1948.

Experiments carried out in Texas in 1946 showed that protection of cotton fruits from insect injury early in the season does not necessarily increase the total yield [*cf. R.A.E.*, A **36** 231–232], and additional field-plot experiments with dusts were carried out in 1947 to find the minimum number of applications that could be made for the control of all cotton insects and yet maintain a maximum yield.

The following is based largely on the authors' summary. Early-season applications of 5 per cent. DDT in sulphur or 5 per cent. DDT, enough BHC (benzene hexachloride) to give 3 per cent. γ isomer and 40 per cent. sulphur did not prevent increases of thrips or increase the yield. Apparently the yield was slightly reduced on plots that received treatments against thrips when the cotton had 4–8 leaves ; if cotton is forced to set fruit early, this tends to retard vegetative growth and apparently reduces the yield. Calcium arsenate and sulphur (1 : 2) reduced populations of *Psallus seriatus*, Reut., but was less effective than DDT, BHC and sulphur. The control of *P. seriatus* and *Anthonomus grandis*, Boh., with calcium arsenate during June contributed to increased yields, owing to unfavourable weather conditions for fruit production in early August and the fact that calcium arsenate does not control weevils rapidly, requiring at least a fortnight to do so. When calcium arsenate was used throughout the season, two applications of nicotine sulphate were necessary for the control of the Aphid [*Aphis gossypii*, Glov.] in July and August. The mixture of DDT, BHC and sulphur controlled the weevil quickly and allowed the cotton to fruit again in a minimum period of time. It protected the fruit adequately from injury by *Heliothis armigera*, Hb., late in July. In spite of the fact that there was no control of *P. seriatus* and that weather conditions were unfavourable, the plot receiving six applications late in the season yielded practically as much cotton as those dusted eight or eleven times. These results indicate that it is more profitable to dust cotton with a quick-acting, effective insecticide during the last three weeks of July and August when *Anthonomus* and *Heliothis* are most injurious, than to try to protect the fruit during the entire season.

HATCH (M. H.) & HOUK (H.). *Adalia bipunctata* **in Buildings in Washington.**—*J. econ. Ent.* **41** no. 3 p. 412. Menasha, Wis., 1948.

Hibernating adults of *Adalia bipunctata*, L., the only introduced Coccinellid in the Pacific Northwest of the United States, frequently occur in small numbers in houses in Seattle, and in the winters of 1947–48 and several years previously very large numbers were present in many buildings in the coal mining community of Black Diamond, Washington. In March 1948, it was reported that it was more difficult there to find buildings without beetles than with them. Beetles that gathered on the outer walls, perhaps attracted by the warmth, and entered through any available crevices generally seemed to be the source of infestation rather than hibernating masses within the buildings, though a mass of beetles 6–8 inches deep and over a yard square was found in a coal shed in the spring of 1946.

FRINGS (H.). **Inorganic Salts as Repellents for Package-penetrating Insects.**—*J. econ. Ent.* **41** no. 3 pp. 413–416, 9 refs. Menasha, Wis., 1948.

The results are given of tests in which heavy bond paper and cardboard were impregnated with ammonium chloride or ammonium nitrate and either made into packages containing food that were exposed to penetration by adults of *Periplaneta americana*, L., and larvae of *Tenebrio molitor*, L., and *Tenebroides mauritanicus*, L., or used to form small cages in which the insects were confined. Although no practical suggestions could be made as a result of the tests, it was found that both salts were repellent, ammonium chloride being superior. They had the advantage over organic compounds of being non-volatile and non-odorous, and it was possible to keep them from dissolving out of the packing material or getting into the foods in the packages by wax coatings. The results obtained emphasised that proper sealing and construction of packages is probably the most important factor in excluding insect pests from packaged foods.

METCALF (R. L.). **Some insecticidal Properties of Fluorine Analogues of DDT.**—*J. econ. Ent.* **41** no. 3 pp. 416–421, 15 refs. Menasha, Wis., 1948.

One of the most interesting analogues of DDT to attain commercial importance as an insecticide is 2,2-bis(p-fluorophenyl)-1,1,1-trichlorethane, more commonly known as fluoro-DDT, DFDT or fluorogessarol. It has a boiling point of 177–178°C. at 9 mm. mercury, its vapour pressure being thus about 15 times that of p,p′DDT, and in the presence of dilute alcoholic alkali, it liberates one mole of hydrogen chloride per mole of compound to form 2,2-bis(p-fluorophenyl)-1, 1-dichlorethylene. It is about 8–10 times as soluble as DDT in organic solvents, and more soluble in refined mineral oil and kerosene than DDT is in xylene, so that for use in insecticide formulations, it does not need auxiliary solvents. It is also highly soluble in certain emulsifying agents, so that equal parts by weight of 90 per cent. technical fluoro-DDT and certain oil-soluble emulsifiers form clear solutions, which, when emulsified with water, form stable emulsions of any desired concentration of fluoro-DDT. The concentrate of fluoro-DDT and emulsifier can also be added to mineral oils or kerosene in any proportion and then emulsified in water to form stable emulsions. A non-ionic emulsifier (Atlox 1045a) was the most suitable of about twenty tested, although an alkylated aryl polyether alcohol (Triton X-100) was fairly effective. Fluoro-DDT is readily formulated into conventional dusts and wettable powders by blending with suitable carriers. A 50 per cent. mixture of 97 per cent. technical fluoro-DDT with clay or diatomaceous earth was free-flowing, but an oily phase separated on wetting ; the addition of 1 per cent. wetting agent produced a material that wet readily and remained uniform. Limited data in the literature indicate that fluoro-DDT is somewhat less toxic than DDT to warm-blooded animals, but, like DDT, it has been shown to accumulate in the perirenal fat, whereas the related 2,2-bis(p-fluorophenyl)-1,1,1-trifluoroethane does not ; this appears to indicate that the property of accumulating in fatty tissue in compounds of the DDT type is associated with the trichlormethyl group.

Data on the speed and quantity of insecticidal action against *Drosophila melanogaster*, Mg., and *Heliothrips haemorrhoidalis*, Bch., of deposits on filter paper of a series of pairs of compounds of the general DDT type identical in structure except for the interchange of chlorine and fluorine atoms, showed that the substitution of fluorine atoms for chlorine in the p,p′ positions of the aromatic rings resulted in a more rapid insecticidal action wherever the aliphatic portion of the molecule was adequate for the production of an appreciably toxic compound, as where it was trichlorethane, trifluoroethane, dichlorethane or dichlorethylene. The substitution of a trifluoromethyl group for a trichlormethyl group in the DDT or fluoro-DDT molecule resulted in a markedly decreased toxicity. The substituted trichlorethanes and dichlorethanes were outstandingly toxic, DDT appearing slightly more toxic than fluoro-DDT and DDD than fluoro-DDD, but in all other pairs of compounds, the fluorine derivatives were slightly more toxic than the corresponding chlorine derivatives, though none appeared to possess adequate insecticidal properties.

In laboratory tests with DDT (melting point 108–109°C.) and fluoro-DDT (m.p. 40–42°C.), deposits of DDT were more effective than those of fluoro-DDT in preventing settling by crawlers of *Aonidiella aurantii*, Mask., on sprayed grapefruits. On filter papers, DDT was more toxic than fluoro-DDT to adults of *D. melanogaster*, but less rapid in action and in some cases less toxic against adults of *Blattella germanica*, L., *Oncopeltus fasciatus*, Dall., *Lucilia sericata*, Mg., *Pogonomyrmex barbatus*, F. Smith, and honey bees. When tested on filter paper against adults of *Tribolium confusum*, Duv., and *Cantharis consors*, Lec., fluoro-DDT was more effective than DDT, and both much more so than fluoro-DDD and DDD, respectively. When the insects were placed on leaves treated with 5 per cent. dusts, fluoro-DDT was the more effective against adults of *Listroderes obliquus*, Gylh., and DDT against larvae of *Phryganidia californica*, Pack., and in 10 per cent. moist-bran baits, DDT was more effective than fluoro-DDT against larvae of *Apantesis proxima*, Guér. Neither DDT nor fluoro-DDT caused any mortality in 24 hours of adults of *Paratetranychus citri*, McG., placed on oranges dipped in acetone solutions. Deposits of fluoro-DDT were found to lose their toxicity much more rapidly than those of the less volatile DDT, which gave relatively constant mortality of *Heliothrips haemorrhoidalis* on dipped oranges for a fortnight after application (95 per cent. after 14 days) whereas fluoro-DDT gave complete mortality after 30 minutes, 32 per cent. after one day and 17 per cent. after four days.

MUNGER (F.). **Body-temperature Measurements of the California Red Scale.**—*J. econ. Ent.* **41** no. 3 pp. 422–423, 3 refs. Menasha, Wis., 1948.

In order to determine the body temperature that *Aonidiella aurantii*, Mask., attains in California [*cf. R.A.E.*, A **22** 553] and the relation between the temperatures of scale, food-plant and air and the solar radiation, nearly simultaneous temperature measurements of the scale and the food-plant very close to the scale were made in the field near Redlands and Whittier, and records were made of air temperature and, in most cases, solar radiation.

In the shade at both places at air temperatures of 81–91°F., the scale temperature was closely related to the temperature of the food-plant, being never more than 1·2° higher or 1·4° lower, there was no constant difference in temperature between scales on lemon fruit and those on wood, and plant temperature agreed closely with air temperature. In the sun near Whittier, the air temperature varied from 74·5 to 96·8°F. and the temperature of the scales averaged 12·2°F. higher than that of the air but only 1° higher than that of the food-plant. The greatest deviation of scale temperature from air temperature was +18·4°F. for a scale on lemon fruit when the air was at 86·9°F. and the fruit at 102·9°. At Redlands, the air temperature ranged from 80·6 to 106·5°F. There was no correlation between solar radiation and air or scale temperature, but a negative correlation between air temperature and the deviation of scale temperature from it, the greatest deviation of scale from air temperature being +21·2° when the air temperature was 84° and the fruit temperature 103·1°F.

MUNGER (F.) & CRESSMAN (A. W.). **Effect of constant and fluctuating Temperatures on the Rate of Development of California Red Scale.**—*J. econ. Ent.* **41** no. 3 pp. 424–427, 1 fig., 12 refs. Menasha, Wis., 1948.

The following is largely the authors' summary. In an investigation at Whittier, California, data were obtained on the rate of development at constant temperatures ranging from 18 to 34°C. [64·4–93·2°F.] and continuously varying temperatures fluctuating between 18 and 30°C. [86°F.] of two strains of *Aonidiella aurantii*, Mask., that differed in their resistance to hydrocyanic acid gas. There was little or no difference in the response of the strains to temperature [*cf. R.A.E.*, A **37** 165], and fluctuation of temperature did not produce any acceleration in the rate of development of either.

AVENS (A. W.), CHAPMAN (P. J.) & PEARCE (G. W.). **Determination of 4–6 Dinitro-o-Cresol on Bark Surfaces and some of its Applications.**—*J. econ. Ent.* **41** no. 3 pp. 432–435, 2 figs. Menasha, Wis., 1948.

In connection with a study of DNC (4,6-dinitro-o-cresol [numbered with OH as 1]) as an Aphid ovicide, a method was developed for the determination of the quantity of this toxicant deposited on the bark of twigs in spraying. This method, which is described in detail, consists essentially of removing the DNC with petroleum ether, converting it to the highly coloured yellow sodium salt and measuring the colour intensity by means of a photoelectric colorimeter. Although the sodium salt of DNC is not soluble in petroleum ether, the method proved satisfactory for this compound also, and it was apparent that the salt was converted to the free acid either during or before extraction with petroleum ether.

The amounts of DNC deposited on bark surfaces were found to vary with different species of plants, and the deposits obtained on 15 different plants sprayed with 0·0015–0·024 per cent. concentrations are given in a table. Plants showing great differences in the character of the bark also showed great differences in the amounts of deposit retained, most being retained by rough bark with many crevices. Wetting agents were found to improve the deposit on the bark but not the rate of kill of Aphid eggs, possibly because they produce a more even but lighter deposit. However, the inclusion of a wetting agent is probably advantageous under orchard conditions.

It is possible that there is a difference in the amount of DNC deposited on the eggs and the surface on which they rest. It is not known whether this introduces a significant complication, but if so, it is probably not great.

MUNDINGER (F. G.). **Experiments on Control of the Eastern Raspberry Fruitworm.**—*J. econ. Ent.* **41** no. 3 pp. 436–440, 3 figs. Menasha, Wis., 1948.

Byturus rubi, Barber, which is common in most raspberry plantings in New York State, was unusually destructive in 1944, when more than 50 per cent. of the fruits were infested in some places. Investigations were therefore begun to determine the effectiveness of different insecticides and the more exact timing of treatments through correlation with the stages in plant development.

The adults begin to emerge from the soil during late April and early May and feed first on the young leaves and later on the pedicels of the blossom buds and on the individual flower buds. They become scarce about the second week in June, though they were taken in the field on 1st July in 1946. Maximum oviposition occurs during the pre-blossom period, most of the eggs being laid on the enlarged blossom buds ; they are commonly deposited along the tips of the sepals, but a few may be found inside the buds and some occasionally on the young fruits. The larva attacks the receptacle, which is frequently reduced to a decayed mass from which the berry drops, and the carpels, when it not only injures the fruit, but leaves damaged tissue in which destructive fungi usually develop. Most of the larvae become full fed probably about the middle of July, after which they construct pupal cells approximately half an inch below the surface of the soil.

Most insecticides were applied during the pre-blossom period, and tests were made in 1940 and 1945–47. The following is based on the author's conclusions. DDT, applied in sprays at the rate of 1 lb. per 100 U.S. gals. with a spreader or in 3–5 per cent. dusts gave the greatest reductions of infested fruit of all the insecticides tested. Ground derris or cubé root, applied in sprays at 5 lb. per 100 U.S. gals. or in dusts containing 1 per cent. rotenone, were also very effective, but lead-arsenate sprays and dusts were less so in almost all tests. Although commercial control was obtained with one application in 1940 and 1946, two are advised. When DDT or rotenone is used, the first application should be made just after the blossom buds appear and the second a few days before bloom. Since these insecticides are both contact and stomach poisons, they are preferable to lead arsenate, which is probably more effective if used after the blossom buds have separated so that it reaches all surfaces of the cluster buds, particularly when applied as a spray. In practically all tests, dusts were more effective than sprays.

Since blossom-bud development varies with the variety of raspberry and also with the season, and since the early activities of the beetles appear to be closely correlated with bud development, varieties that do not mature fruit too early may be used as an index for timing the control applications. When two treatments are made, there seems to be considerable latitude in timing. For control, it is necessary to maintain a protective cover for at least two weeks before the blossoms open. Protection from insect injury is more difficult in seasons with a long pre-blossom period, since the insecticidal cover must be maintained longer and conditions are favourable for more extensive oviposition. The sprays and dusts should be directed into all crevices between the leaf blades and among the cluster buds.

FRAZIER (N. W.) & BARNES (D. F.). **Experiments for Control of the Grape Leaf Folder in California.**—*J. econ. Ent.* **41** no. 3 pp. 441–442. Menasha, Wis., 1948.

The results are given of tests in California in which some of the newer organic insecticides were compared with cryolite for the control of larvae of *Desmia funeralis*, Hb., on grape vine, to which they often cause heavy damage in restricted areas. They feed on the webbed leaves in the early stages and later roll the leaves.

In 1946, a dust containing 5 per cent. DDT, 50 per cent. sulphur, which is required against powdery mildew, and 45 per cent. filler, applied at the rate of 20 lb. per acre during the feeding period of the first generation, did not give control, but one of 45 per cent. cryolite and 55 per cent. sulphur, applied at the same rate and time gave control for the whole season ; a second application of this when the second generation was feeding did not increase its effectiveness, and more foliage was eaten when it was applied against the second generation instead of the first. Dusts of 50 per cent. sulphur with 0·75 per cent. γ BHC (benzene hexachloride) or 5 per cent. chlordan, applied during the feeding period of the third generation in September, reduced the numbers of larvae in rolled leaves three weeks later by more than 50 per cent.

In 1947, nine dusts were applied against the first generation on 17th April, shortly after hatching began, and to other plots on 30th April, when the larvae were entering the third instar. Counts 3–4 weeks later, when all larval stages were present, of the numbers per vine of larvae in rolled leaves, which appeared to be the most satisfactory criterion, showed that a dust of cryolite, DDT and sulphur (50, 5 and 40 per cent.) and one of parathion and sulphur (1 and 55 per cent.) were outstandingly effective, and dusts of 0·75 per cent. γ BHC or 5 per cent. chlordan, each with 50 per cent. sulphur, were promising, whereas 5 per cent. DDD, DDT, xanthone or chlorinated camphene [toxaphene] with 50 per cent. sulphur or 3·3 per cent. di-2-ethylhexyl phthalate with 33·3 per cent. sulphur were much less effective. Further examination of plants dusted with cryolite and DDT or with parathion 6–7 weeks after treatment showed that some of the larvae that were feeding among webbed leaves at the time of the first examination had survived and made leaf-rolls. The largest increase in rolled leaves occurred where parathion had been used, and it appeared that this material lost its effectiveness before the larvae completed their feeding and that another application would have been necessary to maintain control. No recommendation can be made for the use of parathion on grapes until more is known about the possible residues involved.

HAMILTON (D. W.). **Pear Psylla Control with Dormant Sprays.** —*J. econ. Ent.* **41** no. 3 pp. 443–445, 4 refs. Menasha, Wis., 1948.

The following is largely based on the author's summary. Field tests of dormant sprays for the control of *Psylla pyricola*, Först., on pear were made near Poughkeepsie, New York, from 1943 to 1947. When properly timed, sprays of oil emulsion, dinitro-o-cresol or its salts, dinitro-o-sec.-butylphenol, or combinations of dinitro-o-cresol or its sodium salt with oil emulsion gave excellent control early in the season. Thorough spraying in the spring before green tissue began to show in the buds slowed down the rate of increase of the Psyllid in seasons that were ideal for its development, such as 1946 and 1947, and maintained commercial control throughout the season in years in which conditions were less favourable, such as 1943–45.

Oils ranging in viscosity from 90 to 200 Saybolt were about equally effective at a concentration of 3 per cent., and no differences were found in the control given by oils of high paraffinic and high naphthenic base. An oil with a viscosity of 100 Saybolt was about as effective at 2 per cent. as at 3 per cent. Combinations of 2 per cent. dormant oil with 0·5 per cent. sodium dinitro-o-cresylate spray material containing 20 per cent. of the salt gave excellent control of both adults and eggs, and could therefore be applied at any time between the emergence of the adults from hibernation and the appearance of green tissue in the buds. Sprays of 2 lb. 50 per cent. DDT wettable powder per 100 U.S. gals. and of 3 lb. benzene hexachloride (containing 5 per cent. γ isomer) per 100 U.S. gals. were ineffective when used to reduce the populations of adults present during the dormant season.

BRUNSON (M. H.) & ALLEN (H. W.). **Oriental Fruit Moth Cocoon Parasites.**—*J. econ. Ent.* **41** no. 3 pp. 446–450, 7 refs. Menasha, Wis., 1948.

Observations on the identity and importance of the parasites that attack the cocoon stages of *Cydia* (*Grapholitha*) *molesta*, Busck, on peach in New Jersey and other eastern States were carried out intermittently between 1931 and 1945. Cocoons were collected from trap-bands, or reared in the laboratory and exposed on the trees, and taken to the laboratory for emergence. The percentages of cocoons parasitised were estimated from the total numbers from which insects emerged, and the percentages of secondary parasitism from the total numbers that yielded parasites.

Cocoons in trap-bands that remained on the trees for 3–8 weeks between about June and September in nine counties in New Jersey and Pennsylvania in 1931 and 26 counties in these States and Connecticut, Maryland, Massachusetts, New York, Ohio, and Virginia in 1932 gave rise to eleven species of primary cocoon parasites. *Dibrachys cavus*, Wlk., *Eupelmus spongipartus*, Först., *Eurytoma appendigaster*, Swed., *Agrothereutes* (*Gambrus*) *ultimus*, Cress., *Haltichella xanticles*, Wlk., and *Mastrus pilifrons*, Prov., each parasitised 1 per cent. or more of the cocoons in at least one State, and *Ephialtes* (*Calliephialtes*) *variatipes*, Prov., *Pimpla* (*Coccygomimus*) *inflata*, Townes, *Encyrtaspis semirufus*, Gah., *Itoplectis conquisitor*, Say, and *Nemorilla floralis*, Fall., were reared in smaller numbers. The percentage parasitism frequently approached 100 in individual orchards, and was as high as 42 in one county in New Jersey in 1931 and 51 in one in Virginia in 1932. The average for all collections was 15·3. Cocoons that were reared in the insectary and exposed in New Jersey for 3–8 days between April and October in 1931–35 and for 11 days in June–July in 1940 and 1945 gave rise to *Ephialtes* (*Calliephialtes*) *grapholithae*, Cress., *P. inflata*, *D. cavus*, *Encyrtaspis semirufus*, *Eupelmus spongipartus*, *Eurytoma appendigaster*, *Hemiteles* (*Gelis*) *tenellus*, Say, *I. conquisitor*, *Lymeon orbus*, Say, *M. pilifrons* and *Phaeogenes walshiae*, Ashm., each of which parasitised at least 1 per cent. of the cocoons in one or more years, and *Arachnophaga frontalis*, Gah., *Ephialtes* (*Scambus*) *hispae*, Harr., *Eupelmus cyaniceps* var. *amicus*, Gir., *E. limneriae*, How., *H. xanticles*, *Agrothereutes ultimus*, and *Syntomosphyrum esurus*, Ril., which were less numerous. The percentage parasitism averaged 15·5 but was again variable. It was evidently an important adjunct to larval parasitism in many orchards in reducing the population of *Cydia*.

Secondary parasitism occurred generally in all the States in which observations were made, and in 1932, 32 per cent. of the parasites in cocoons exposed in eight States were attacked by hyperparasites. In 1940 and 1945 the average hyperparasitism was 59 and 76 per cent., respectively. It was found that many of the primary cocoon parasites also attacked larval parasites and other cocoon parasites. During 1932 and the first broods of 1940 and 1945, *A. frontalis*, *E. spongipartus*, *D. cavus*, *Hemiteles tenellus* and *Eurytoma appendigaster* occurred as secondary parasites more often than as primary parasites and *Encyrtaspis semirufus*, *L. orbus*, *P. inflata* and *M. pilifrons* more often as primary than as secondary parasites. It appears that the first five species searched out parasites for attack.

NEISWANDER (R. B.). **Plum Curculio on Peaches and Plums in Ohio.**—*J. econ. Ent.* **41** no. 3 pp. 450–453, 6 figs., 5 refs. Menasha, Wis., 1948.

Observations on *Conotrachelus nenuphar*, Hbst., on peaches and plums in northern Ohio during each of the six seasons from 1942 to 1947 showed that the lengths of the oviposition and larval feeding periods and the numbers of larvae that completed their development in the fruits and that gave rise to adults varied greatly from season to season because of variable weather. There is only one generation a year. Control investigations made over the same period showed that fluorine sprays caused more injury to peach foliage than acid lead arsenate and were less effective [*cf. R.A.E.*, A **34** 201], that basic lead arsenate, with or without hydrated lime, was no safer than acid lead arsenate when used at equally effective concentrations, and that the degree of control given by 1–3 applications of 2–3 lb. acid lead arsenate per 100 U.S. gals. varied directly with the amount of lead arsenate applied, the addition of 4 lb. zinc sulphate and 6 lb. hyhrated lime, 2 lb. ferric dimethyldithiocarbamate, or 1·5 lb. of a zinc safener to 2 lb. lead arsenate per 100 U.S. gals. apparently reducing the danger of plant injury significantly, but not eliminating it. In 1946 and 1947, two or three sprays of 3 lb. BHC (benzene hexachloride), containing 6 per cent. γ isomer, per 100 U.S. gals. were much more effective than two or three of lead arsenate during the early part of the season, but did not remain effective for so long. Five applications of BHC at intervals of ten days, beginning at petal-fall, were better than three of BHC or two of lead arsenate, and caused no foliage injury on peach or plum and no deleterious flavour in the fruit. Because of the possible incompatibility of lime and BHC, the use of the latter on plums may be inadvisable if fixed copper and lime are needed for the control of leaf spot, but since lead arsenate causes less damage on plum than on peach, the need for a substitute for it is less acute.

OSBURN (M. R.) & MATHIS (W.). **Effect of DDT on Florida Red Scale Populations.**—*J. econ. Ent.* **41** no. 3 pp. 454–456, 6 refs. Menasha, Wis., 1948.

The following is substantially the authors' summary. The results of three field experiments carried out in St. Lucie County, Florida, during 1944–47 showed that sprays containing DDT were not satisfactory in reducing infestations of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) on orange, and that in fact its numbers increased abnormally after the use of this insecticide. Increases were greater after applications of a suspension of wettable DDT than after sprays of either oil or xylene containing DDT, and less after spraying with an emulsive oil containing DDT than after any other DDT treatment. The emulsive oil alone at 1, 1·5 or 1·75 per cent. prevented reinfestation better than any other treatment.

Some of the scale increases associated with all the DDT treatments are attributed to the absence of scale parasites and predators, which were destroyed by the DDT, but the abnormally high populations associated with wettable DDT used alone were also favoured by the presence of large quantities of inert residue [*cf. R.A.E.*, A **27** 257], which remained on sprayed trees for a considerable time.

DOWDEN (P. B.), BUCHANAN (W. D.) & CAROLIN (V. M.). **Natural-control Factors affecting the Spruce Budworm.**—*J. econ. Ent.* **41** no. 3 pp. 457–464, 14 refs. Menasha, Wis., 1948.

Choristoneura (*Archips*) *fumiferana*, Clem., has periodically caused widespread destruction of balsam fir [*Abies balsamea*] and spruce [*Picea*] in Canada, the north-eastern part of the United States and the Lake States, and in 1945, heavy infestation broke out in the Adirondacks of New York. An intensive study of natural control factors was begun, and similar studies were made in Colorado, where Douglas fir [*Pseudotsuga taxifolia*] is the principal tree attacked [*cf. R.A.E.*, A **33** 314], and most of the parasites recorded in British Columbia [**36** 78] were found to be present.

The following is based on the authors' summary. Lists are given of 45 primary and seven secondary parasites of *C. fumiferana* compiled from the records made and from the literature. Birds are important predators of the budworm, but are apparently more effective against light than against heavy infestations. Very few diseased larvae or pupae were observed. In some years, late spring frosts kill large numbers of larvae. Parasitism was generally high in both heavy and medium infestations in the Adirondacks and in Colorado. Aggregate percentage mortality due to biotic factors ranged from 49 to 81 in eleven study plots in the Adirondacks in 1946 and from 34 to 72 at seven collection points in Colorado in 1945, where egg parasitism and mortality of fourth-instar larvae, which were recorded in the Adirondacks, were not measured. It is reported that heavy infestations that had been under way for at least 7–8 years on the eastern slopes of the Rocky Mountains in Colorado had practically disappeared in 1947.

In the course of the investigations, two species of parasites not present in the eastern United States, *Phytodietus fumiferanae*, Rohw., and *Ceromasia auricaudata*, Tns., were introduced from Colorado into the Adirondacks, and colonies of *Phytodietus*, *Agria affinis*, Fall., *Madremyia saundersi*, Will., and

Winthemia (*Omotoma*) *fumiferanae*, Toth., received from Canada were released there. It was proposed to collect the introduced Tachinid, *Compsilura concinnata*, Mg., in New York in 1947 for liberation in Colorado.

Hoffmann (C. H.) & Merkel (E. P.). **Fluctuations in Insect Populations associated with aerial Applications of DDT to Forests.**—*J. econ. Ent.* **41** no. 3 pp. 464–473, 2 refs. Menasha, Wis., 1948.

The following is substantially the authors' summary. Since the spring of 1945, large forest areas in various parts of the United States have been sprayed with DDT either for the control of destructive pests or to determine the effects of such treatments on animal communities. Study plots of 100–600 acres were established in some of these areas to observe effects on the more abundant insect species. In some instances, it was possible to follow closely the effect of the residues for 1–3 months after spray applications of 1–7·5 lb. DDT per acre. Regardless of dosage, the kill of insects shortly after spraying was tremendous. The toxicity of the 1 lb. dosage lasted for about a week and that of the 2 lb. dosage for about two weeks, whereas the 5 lb. dosage gave high kills after six weeks and did not permit much recovery for three months.

There was great variation in susceptibility of insects to DDT, partly owing to the degree of contact with the poison, which is influenced by individual ecology, habits, seasonal life-history or structure. Exposed species were affected more than those protected by foliage, bark, burrows or the leaf mould and soil. The timing of the spray was most important. The species that were in a susceptible stage, such as the larvae and flying adults of many orders, were severely reduced. Hairy species, such as butterflies, moths and bees, seemed quite resistant. After one spray application at the rate of 5 lb. DDT per acre, there was a loss of natural enemies of Aphids and Tetranychid mites, and outbreaks of both groups developed ; these, however, were of short duration.

A single aeroplane application of DDT to the forest at the rate of 1 lb. per acre, which is sufficient to control many forest defoliators, would probably not affect the terrestrial Arthropod fauna seriously, since only a few species might be eliminated. Dosages of 5 lb. DDT per acre threaten extermination of many species, but do not cause catastrophic losses.

The results of aeroplane applications of 1 lb. DDT per acre to fish-food organisms in both cold-water and warm-water streams are reported. Sprays of DDT in oil destroyed about 90 per cent. of the invertebrates at the lower stations in the treated sections of three streams, whereas losses of invertebrates in a stream sprayed with a suspension at the same dosage amounted to only about 70 per cent. at the lower stations. Regardless of the treatment, all the streams studied had more invertebrates per square foot a year later than at the time of the pre-treatment sampling. In one stream the species composition had changed, and some forms with a short life-cycle had replaced others with a longer one, which had been almost eliminated by the spray.

To summarise broadly, it appeared that aeroplane applications of DDT at the rate of 1 lb. per acre, which afford good control of many forest pests, cause no permanent damage to most forest- and stream-inhabiting animal populations [*cf. R.A.E.*, A **35** 177].

Eckert (J. E.). **Toxicity of some of the newer Chemicals to the Honeybee.**—*J. econ. Ent.* **41** no. 3 pp. 487–491. Menasha, Wis., 1948.

Since the newer insecticides that are effective at low dosages are likely to replace the arsenicals, which have to be applied at high rates to control insect pests of plants and have for this reason in particular proved rather harmful to colonies of honey bees, the toxicity of some of the former to the bees was investigated. The author's experiences with DDT have indicated that at the dosages normally used it has sometimes caused a marked reduction in the field force of honey bees, but never killed a colony. He describes the laboratory methods employed to test a number of poisons and concludes from experiments in which bees were fed with solutions in sugar-syrup that the median lethal dose per bee is between 0·24 and 0·34 mmg. for hexaethyl tetraphosphate; 0·075 mmg. for tetraethyl pyrophosphate and 0·07 mmg. for parathion. These insecticides will incapacitate bees for a few hours in quantities less than the median lethal doses. They act as both contact and stomach poisons, and parathion also showed considerable toxicity to bees as a fumigant. DDD, with a median lethal dose of 16 mmg. per bee, appears to be less toxic than any of the other chlorinated hydrocarbons and would apparently be non-toxic at concentrations below 1 : 5,000. Chlordan was highly toxic to bees as a stomach and contact poison and fumigant ; the median lethal dose was about 1 mmg. per bee, and spray residues killed bees for several weeks under laboratory conditions. Neither the phosphates nor the hydrocarbons showed any repellent action to bees when dissolved in sugar syrup or when sprayed on surfaces over which the bees walked.

Owing to the small amounts of the phosphates and hydrocarbons that are required against injurious insects, it would seem highly probable that neither will be as injurious to bees as arsenicals, but their toxicity will depend on the conditions under which they are applied. The rapid loss of toxicity of the phosphates will also reduce losses of bees when the insecticides are properly applied. However, losses will result if the newer chemicals are applied in such amounts or at such times as to permit the bees to secure a lethal dose either through contact, fumigant action or ingestion. It would be desirable to confine insecticides to the fields treated, to refrain from treating plants in bloom, and to use the chemical that is least toxic to beneficial insects.

DEAY (H. O.) & ULMAN (P. T.). **DDT as a Summer Spray against European Elm Scale.**—*J. econ. Ent.* **41** no. 3 p. 506. Menasha, Wis., 1948.

Sprays containing 0·5, 1, 2, 3 and 4 per cent. actual DDT as a wettable powder or 0·5 or 2 per cent. as a 25 per cent. emulsifiable oil solution were applied to American elm [*Ulmus americana*] near Bridgeport, Indiana, for the control of *Gossyparia spuria*, Mod., on 19th July 1946 when nearly all the crawlers had settled on the leaves. The percentages of scales dead on 29th July and 7th August were 7 and 8·6 on unsprayed trees, 78·2 and 97·7 on those sprayed with the lowest concentrations of the wettable powder, and 91·4–98·2 and 97·8–99·4 on the other sprayed trees. On 14th July 1947, no scales were found on the trunks or leaves of any of the treated trees, but they were abundant on untreated ones. The wettable-powder spray containing 2 per cent. DDT caused slight scorching of the leaves, and those containing 3 and 4 per cent. moderate scorching, and 2 per cent. DDT in oil caused severe scorching of the leaves and about 50 per cent. leaf-drop within 20 days ; the lower concentrations caused no visible injury and left the foliage in better condition than that on untreated trees. In July 1947, no injury resulting from spraying could be detected.

CLANCY (D. W.) & POLLARD (H. N.). **Effect of DDT on several Apple Pests and their natural Enemies.**—*J. econ. Ent.* **41** no. 3 pp. 507–508, 4 refs. Menasha, Wis., 1948.

Comparative studies on the effects of DDT and lead arsenate on the populations of *Paratetranychus pilosus*, C. & F., *Tetranychus* spp., *Eulia* (*Argyrotaenia*) *velutinana*, Wlk., and *Pseudococcus comstocki*, Kuw., on apple sprayed for the control of the codling moth [*Cydia pomonella*, L.] were begun in Virginia in 1947. In six orchards sprayed with DDT or lead arsenate only, or with both, mites were consistently more numerous in early summer on trees treated with lead arsenate than on those treated with DDT, but in September they became slightly more numerous on the latter. There were no severe outbreaks after heavy schedules of DDT, and although high populations occurred throughout the summer in all the six orchards, there was no severe bronzing and little apparent injury to the foliage, possibly owing to unusually favourable growing conditions. *P. pilosus* comprised 88 per cent. of the total number of eggs and mites, and most of the remainder were *Tetranychus bimaculatus*, Harvey, with a few that resembled *T. schoenei*, McG. Species of *Tetranychus* were present in all the orchards, but outnumbered *P. pilosus* only in one that had received a heavy DDT schedule. Mite predators were very scarce until August and September, when a general increase occurred in most of the orchards, but with one exception this was too late to have any appreciable effect, except on the overwintering mite populations. In one orchard treated with lead arsenate the infestation dropped from 44 to five mites per leaf immediately after a rapid influx of predators early in August, and there was a similar reduction two weeks later in a neighbouring block of trees that had received five applications of DDT between 6th May and 17th June. *Stethorus punctum*, Lec., was the most important mite predator and comprised 80 per cent. of the total predator population ; this Coccinellid was readily killed by DDT. A predacious mite of the genus *Iphidulus*, *Leptothrips mali*, Fitch, and *Scolothrips sexmaculatus*, Perg., were very scarce except late in the summer or in blocks where DDT was not used. Other predators of less importance were various Chrysopids, Coccinellids and Syrphids, the Mirids, *Hyaliodes harti*, Knight, and *H. vitripennis* var. *discoidalis*, Reut., and the Anthocorid, *Orius insidiosus*, Say. For the most part, the predators were irregular in distribution and abundance even under apparently favourable conditions, and although the use of DDT resulted in their suppression for 5–6 weeks after the final spray and in some cases may have prevented successful biological control, the general ineffectiveness of mite predators in the orchards observed in 1947 seemed to be due as much to their initial scarcity and irregular distribution as to the use of DDT.

In central and northern Virginia, populations of the first generation of *E. velutinana* were comparatively small in most orchards in which lead arsenate was used alone or in combination with DDT, but a general increase occurred in the second and third generations, especially where the heavier DDT schedules had been applied. It was evident that both DDT and lead arsenate killed most of the young larvae, but survival was generally somewhat higher after DDT. It appeared that the lower populations on trees treated with lead arsenate were due largely to its superiority as a larvicide [*cf. R.A.E.*, A **37** 382], since parasitism was nearly as high on trees sprayed with DDT as on those treated with lead arsenate. About 23 species of parasites, of which three were known to be hyperparasites, were reared from larvae and pupae of the first and second generations. The commonest parasite was *Triclistus fulvipes*, Cress., and *Microgaster epagoges*, Gah., *Goniozus platynotae*, Ashm., and *Phytodietus vulgaris*, Cress., were next in general abundance. *Chrysopa* larvae were apparently sometimes important as predators.

Studies on *Pseudococcus comstocki* on apple in the eastern United States have shown that DDT is extremely toxic to the parasites that normally hold this mealybug in check [*cf.* **34** 336], but although the parasites have been practically eliminated from orchards receiving DDT spray schedules, the treatments have also prevented an increase of the mealybug.

BROMLEY (S. W.). **Mosquito Spraying with DDT and the Two-spotted Mite.**—*J. econ. Ent.* **41** no. 3 p. 508. Menasha, Wis., 1948.

On 14th July 1947, vegetation in a wooded area in Connecticut was sprayed with a suspension of wettable DDT containing 1 lb. actual DDT per 100 U.S.

gals. water for the control of mosquitos. The results against these were very poor, and mites became abundant on the sprayed trees and shrubs. The treated portion of a hedge of *Hydrangea arborescens* became heavily infested by *Tetranychus bimaculatus*, Harvey, within a week. On 21st July, the hedge was sprayed with 0·25 per cent. hexaethyl tetraphosphate. This neither caused spray injury nor effected an appreciable reduction of the mites. The part of the hedge that had been sprayed with DDT was practically defoliated by the end of August. Throughout the area where DDT had been applied, there was a clear line of demarcation between unsprayed vegetation and vegetation that had received DDT. The latter was mostly yellow as the result of a heavy infestation by *Paratetranychus bicolor*, Banks, on the oaks and maples and a fungus leaf spot on azaleas. On 9th March, 1948, half of the terminal buds on the hydrangeas that had been sprayed with DDT were dead, while those living had an average length of only 3·6 mm. In a part of the hedge where DDT had not been used, no buds were dead and the average length was 5·75 mm. The dying and lack of growth on the sprayed shrubs was due to direct injury by *T. bimaculatus* in the late summer of 1947 and also to killing of the terminals and buds in winter following weakening as a result of the infestation.

CHAMBERLIN (T. R.), MEDLER (J. T.) & O'NEAL (E. J.). **Insecticides for Control of Spittlebug Nymphs in Wisconsin.**—*J. econ. Ent.* **41** no. 3 pp. 509–510, 1 ref. Menasha, Wis., 1948.

Further experiments on the control of *Philaenus leucophthalmus*, L., in Wisconsin [*cf. R.A.E.*, A **37** 161] were carried out on strawberries, sweet clover [*Melilotus*] and lucerne in 1947. Hatching was 3–4 weeks later than in 1946 because of continued cold, rainy weather in spring, and nymphal infestations were heavier in the southern and central parts of the State and were again heavy in the east-central part.

One application of 25–30 lb. 5 per cent. chlordan dust per acre to strawberries on 9th June controlled the nymphs almost completely. When applied to sweet clover on 12th June at the rate of 20 lb. per acre, 5 and 2 per cent. chlordan gave very good and fairly good control, respectively, but 5 per cent. DDT had very little effect. In one series of tests on lucerne, sprays of 1 lb. benzene hexachloride (5 per cent. γ isomer), DDT or chlordan per 100 U.S. gals. gave fairly good control, but sprays of 1 pint hexaethyl tetraphosphate or 0·8 pint tetraethyl pyrophosphate per 100 gals. were relatively ineffective, and in another, 5 per cent. chlordan dust was very effective and 2 per cent. chlordan dust less so, but an emulsion concentrate, used at a rate of 1 lb. technical chlordan per 100 U.S. gals., and 1 pint hexaethyl tetraphosphate per 100 gals. were not. The concentrate had been kept from the previous year, which may account for its ineffectiveness. Many more individual nymphs were killed than counts of froth masses indicated, a reduction in the number per mass being correlated with a reduction in the number of masses per plot.

Chlordan thus gave the best control. To be most effective, it should apparently be applied when most of the nymphs are in the first or second instar, as it seems not only to have an immediate action but to leave a residue toxic to nymphs migrating from the lower parts of the stems to the tops of sweet clover or lucerne. It may also penetrate the small newly established froth masses protecting the young nymphs more readily than the larger masses produced by the older ones. A 5 per cent. dust seems strong enough to give complete kill of nymphs within masses on strawberries, where the coverage is usually more uniform than it is on sweet clover and lucerne. However, chlordan cannot be recommended for use on food crops until more is known about the toxicity of the residues to man and livestock.

GAINES (J. C.), DEAN (H. A.) & WIPPRECHT (R.). **Control of Thrips on Cotton.**—*J. econ. Ent.* **41** no. 3 pp. 510–512, 1 ref. Menasha, Wis., 1948.

The results are given of further investigations on the control of thrips, chiefly *Frankliniella tritici*, Fitch, on cotton [*cf. R.A.E.*, A **37** 212], carried out in Texas in 1947. In one test, in which sprays and dusts were applied on 18th April, before the thrips migrated into the field from weeds, 29th April and 13th May at average rates of 11 U.S. gals. and 12·5 lb. per acre, respectively, and all plants received applications of a mixture of BHC (benzene hexachloride), DDT and sulphur later in the season against weevils [*Anthonomus grandis*, Boh.] and bollworms [*Heliothis armigera*, Hb.], a 1 per cent. DDT spray and dusts of 20 per cent. chlorinated camphene [toxaphene], 3 per cent. γ BHC, and 3 per cent. γ BHC with 5 per cent. DDT, all in sulphur, were effective against the thrips, and a spray of 2 oz. tartar emetic and 1 lb. syrup per 3 U.S. gals. water and dusts of 5 per cent. DDD or DDT in sulphur were ineffective. All treatments significantly reduced the percentages of " thrips injured " plants, but did not increase the yield [*cf.* **37** 424]. In a second test, in which dusts were applied on 21st April and 2nd and 14th May at an average rate of 11·5 lb. per acre and all plants received calcium arsenate later in the season for the control of *Anthonomus*, 20 per cent. toxaphene gave good control, and 3 per cent. γ BHC with 5 per cent. DDT or alone in sulphur was less effective and 5 per cent. DDT in sulphur useless. None of the treatments increased the yield. The thrips population was higher in the second test than in the first, but the percentage of " thrips injured " plants was lower, indicating that other factors are probably responsible for this injury [*cf.* **37** 212]. The dust of 5 per cent. DDT in sulphur was less effective than in previous years, possibly owing to different weather conditions.

HAINES (K. A.) & DAVIS (L. G.). **Protection of Workers applying Nicotine Alkaloid as a concentrated Mist Spray.**—*J. econ. Ent.* **41** no. 3 p. 513, 1 ref. Menasha, Wis., 1948.

When making emergency applications with blower equipment of mist sprays of nicotine in kerosene or water at the rate of 16 oz. alkaloid per U.S. gal., to pear trees in the Wenatchee Valley, Washington, late in the dormant season of 1946–47 for the control of *Psylla pyricola*, Forst., some of the operators suffered from nicotine poisoning, the symptoms of which are described. Absorption through the skin seemed to be more detrimental than inhalation of the fumes, although the latter aggravated the symptoms when once the nicotine had been absorbed into the system. Dust-type respirators afforded no protection, but gas masks equipped with special canisters to filter out the nicotine were found effective, and the use of rubber gloves and aprons saved the workers from being splashed with droplets of nicotine during the mixing and tank-filling operations. The spray men were required to keep shirt necks buttoned and sleeves rolled down, to expose as little skin surface as possible, and to change clothes frequently ; they were provided with a protective skin cream, in which nicotine was not soluble, to cover all exposed skin surfaces, and with one charcoal tablet per hour to be chewed and swallowed. As a result of these precautionary measures, all the men were able to work with nicotine alkaloid without suffering any discomfort.

FROST (S. W.). **The Leafhopper** *Cicadella stellulata* **on Cherry.**—*J. econ. Ent.* **41** no. 3 pp. 513–514, 1 fig. Menasha, Wis., 1948.

Cicadella stellulata, Burm., which was found on sour cherry at State College, Pennsylvania, in 1945 [*R.A.E.*, A **35** 57], has since been taken in light traps at six further places in that State, between 30th June and 15th August. It was abundant on hawthorn [*Crataegus*] at State College in 1947. On this food-plant, it was associated with other common Jassids, including the white apple leafhopper, *Typhlocyba pomaria*, McAtee, but it occurred almost alone on sour cherry. Heavy infestations continued on sour cherry at State College, the populations averaging 8–10 per leaf, with nearly every leaf infested. The Jassids feed almost entirely from the lower surface of the leaves ; the nymphs are quite inactive, but the adults readily fly when distrubed.

These observations indicate that *C. stellulata* is not rare, but has been overlooked. Its presence on hawthorn emphasises the fact that ornamental plants may serve as reservoirs for the breeding of this and other insect pests.

WENE (G. P.). **Control of the Cowpea Curculio.**—*J. econ. Ent.* **41** no. 3 pp. 514–515, 1 ref. Menasha, Wis., 1948.

Injury by *Chalcodermus aeneus*, Boh., is a limiting factor in the production of Black Eye cowpeas throughout the Rio Grande Valley of Texas, and preliminary experiments were made to compare the effectiveness of the newer insecticides and cryolite in dusts for its control. In the first test, in which the dusts were applied at 25–30 lb. per acre when injury was first observed and twice more at intervals of about a week, 5 per cent. DDT, 40 per cent. cryolite and 5 per cent. chlordan reduced the percentage of infested pods from 15·3 (on the untreated plot) to 3·3, 5·3 and 4 six days after the second application and from 15·6 to 0·7, 1·7 and 2 six days after the third. In the second, in which two applications were made at an interval of six days, beginning when injury was first observed, 40 per cent. cryolite, 50 per cent. *Ryania*, 1 per cent. parathion, 1 per cent. γ benzene hexachloride and 5 per cent. DDD reduced it from 17·6 six days after the second application to 2·7, 14·7, 3·3, 10 and 5·7, respectively. In the third, made on Purple Hull cowpeas, rain fell a few hours after the first application, so a second one was made after two days and a third after another six. Infestation was very low, but 40 per cent. cryolite reduced damage and 5 per cent. DDT was again slightly superior to it. A dust containing 5 per cent. chlorinated camphene [toxaphene] gave complete control and should be tested further ; 1 per cent. rotenone, and 0·1 per cent. pyrethrins with 0·5 per cent. DDT, did not appear promising.

YOTHERS (M. A.) & CARLSON (F. W.). **Effect of DDT on the Green Peach Aphid and its Coccinellid Predators.**—*J. econ. Ent.* **41** no. 3 pp. 515–516. Menasha, Wis., 1948.

In 1947, peach trees in orchards near Yakima, Washington, were sprayed on 19th March, when they were coming into bloom and about 2–3 weeks after all overwintering eggs of *Myzus persicae*, Sulz., had hatched, for the control of this Aphid and of *Anarsia lineatella*, Zell., and others were sprayed on 7th April, at petal fall, against *A. lineatella*. On 23rd April, trees sprayed on 19th March with a 2 per cent. dormant-oil emulsion containing 3 lb. basic lead arsenate, 3 lb. cryolite or 1 lb. DDT per 100 U.S. gals. had 17, 15 and 6 per cent. of the terminals infested with Aphids, and individual large branches bore 341, 320 and 28 egg-clusters of its Coccinellid predators, mainly *Hippodamia convergens*, Guér., and *Coccinella transversoguttata*, Fald. ; 20 adult Coccinellids were found in five minutes on the trees sprayed with oil and lead arsenate and none on those treated with DDT and oil. Trees sprayed with ¾ U.S. pint nicotine sulphate, 8 U.S. gals. liquid lime-sulphur or a mixture of 1 U.S. pint hexaethyl tetraphosphate and 1 lb. DDT, all per 100 U.S. gals. water, had 13, 18 and 10 per cent. infested terminals and 243, 226 and 5 Coccinellid egg-clusters. The trees treated with the mixture had two Coccinellid adults, and untreated trees 216 egg-clusters and 19 adults. Trees sprayed on 7th April with 1 lb. DDT per 100 U.S. gals. had no Coccinellid egg-clusters and one adult, and those treated with 3 lb. lead arsenate and 3 lb. cryolite had 211 and 173 egg-clusters, respectively. It is evident that DDT with oil or hexaethyl tetraphosphate gave better control of *M. persicae* than the other sprays tested, that Coccinellids were either repelled or destroyed by the DDT residue, and that oviposition of the few Coccinellids that entered the DDT plots was reduced, the egg-clusters found containing only 3–5 eggs each instead of 10–15 as in the other plots. Infestation by *A. lineatella* was too low for any results to be recorded.

DUDLEY jr. (J. E.), BRONSON (T. E.) & STONE (P. V.). **Comparative Effectiveness of three Types of DDT Dust Mixtures against Pea Aphids.**—*J. econ. Ent.* **41** no. 3 pp. 518–519, 1 ref. Menasha, Wis., 1948.

Experiments to compare three types of DDT dust mixtures against *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on canning peas were carried out in Wisconsin in 1945–47. In 1945, when two 5 per cent. dusts were tested, one prepared by dissolving the DDT in a volatile solvent (acetone) and spraying the solution on talc was significantly superior, on the average, to one prepared by grinding DDT with pyrophyllite and diluting it with talc. In 1946, 2·5 and 5 per cent. dusts prepared from DDT dissolved in a volatile solvent (carbon tetrachloride) were equally effective and consistently (but not significantly) better than 5 per cent. ground DDT in pyrophyllite and talc, but a mixture containing 1·25 per cent. DDT from a carbon-tetrachloride solution was much less effective. In 1947, a 1·25 per cent. dust prepared by dissolving DDT in a commercial non-volatile solvent, consisting chiefly of a mixture of di- and trimethylnaphthalenes, and spraying it on talc, was significantly superior to 1·25 and 2·5 per cent. dusts prepared from DDT in a volatile solvent (trichlorethylene) or 5·4 per cent. DDT ground with pyrophyllite and talc, and there were no significant differences between these three.

GAINES (R. C.) & SCALES (A. L.). **Effectiveness of Insecticides on the Boll Weevil in Cotton Squares in 1947.**—*J. econ. Ent.* **41** no. 3 pp. 519–520. Menasha, Wis., 1948.

In 1947, tests were made in Louisiana to determine the effect of various insecticides used as dusts for the control of *Anthonomus grandis*, Boh., on the stages of the weevil within the cotton squares [*cf. R.A.E.*, A **37** 303]. Examination of squares collected on the ground on 11th August, after 3–4 applications of dusts in late July and early August, showed that the percentages of squares with living insects (adults, pupae or larvae), dead insects, emergence holes only and egg punctures only were 41, 3, 17 and 39 on untreated plots, 27, 22, 23 and 28 on those treated with calcium arsenate, with the addition of 2 per cent. nicotine in alternate applications, 41, 29, 7 and 23 for a mixture of 3 per cent. γ BHC (benzene hexachloride), 5 per cent. DDT and 40 per cent. sulphur, 41, 29, 3 and 27 for 20 per cent. chlordan, and 53, 15, 8 and 24 for 3 per cent. chlordan with 3 per cent. DDT.

Squares with egg punctures were collected from untreated plants on 18th August and from the ground under untreated plants on 20th August. Those collected from plants usually contain eggs and young larvae and those from the ground larvae, pupae and adults. Squares collected on 18th were exposed for 21 days in airtight globes to the vapours of 20 per cent. chlordan, 5 per cent. γ BHC, 20 per cent. chlorinated camphene [toxaphene] or 5 per cent. parathion, and those on 20th were dusted fairly heavily with the same materials and kept in the globes for 19 days. The percentages from which adults emerged in the first and (in brackets) second series were 84 (51) for the controls, 0 (0) for chlordan, 4 (0) for BHC, 72 (29) for toxaphene and 10 (8) for parathion. Examination of the squares showed that weevils exposed to chlordan vapour in the first test reached the adult stage and died within the squares. Both larvae and adults died in the second test. BHC killed more in the larval than in the adult stage. When four heavy applications of the same dusts were made to cotton plants on 18th, 22nd and 28th August and 2nd September and cotton squares were collected from the ground 3–5 days after each, the percentages of squares from which adults emerged averaged 57 for no treatment, 70 for parathion, 63 for toxaphene, 41 for BHC and 14 for chlordan.

Dahms (R. G.). **Control of the Greenbug with Insecticides.**—*J. econ. Ent.* **41** no. 3 pp. 520–521. Menasha, Wis., 1948.

In the spring of 1947, various insecticidal dusts were compared for the control of *Toxoptera graminum*, Rond., on winter oats in Oklahoma, where this Aphid is one of the most important pests of small grains. The dusts were applied at about 12 lb. per acre on 19th or 28th March, and statistical analysis of the numbers of Aphids found at the time of treatment and at intervals for 28 days showed no significant difference between dusts containing 1 per cent. rotenone as cubé, BHC (benzene hexachloride) diluted to contain 1 per cent. γ isomer, and 5 per cent. DDT. A dust containing 2 per cent. γ BHC gave significantly better control than these, but significantly less than 3 and 5 per cent. γ BHC, 3 per cent. hexaethyl tetraphosphate or 2·5 per cent. γ BHC with 5 per cent. DDT. The Aphids that were not killed on the plots treated with the phosphate reproduced rapidly, and the control after 14 days was no better than with 2 per cent. γ BHC and only slightly better than with 1 per cent. The Aphids also increased rapidly in the plots treated with 5 per cent. DDT or cubé. The yield was recorded only on the plots treated on the first date. It was low even where control was effective, but was significantly higher on plots treated with 3 and 5 per cent. γ BHC or 3 per cent. hexaethyl tetraphosphate than on untreated plots. The maximum population was higher than the original infestation on all plots but those treated with 3 and 5 per cent. γ BHC, and these two had a better stand and much more vigorous plants throughout the growing period than any others. Adult Aphids caged on plants in these plots 14 days after treatment were able to produce colonies, but none started from natural infestations, and it was evident that alates did not feed or reproduce on the plants.

Metcalf (R. L.) & Lindgren (D. L.). **Insecticidal Properties of elemental Fluorine.**—*J. econ. Ent.* **41** no. 3 p. 522, 3 refs. Menasha, Wis., 1948.

In view of the unusual properties of fluorine and the fact that it has recently became available as a compressed gas, it was tested as a fumigant at rates of 1 and 5·75 gm. per 100 cu. ft. (227 and 1,305 parts per million, respectively) against adults of *Oncopeltus fasciatus*, Dall., *Blattella germanica*, L., *Drosophila melanogaster*, Mg., *Heliothrips haemorrhoidalis*, Bch., *Paratetranychus citri*, McG., *Tribolium confusum*, Duv., and *Aonidiella aurantii*, Mask., and eggs of *P. citri* and *Carpophilus hemipterus*, L. The gas was introduced after drawing a vacuum of 5 cm. mercury in the fumigation chamber, and air was then admitted to restore atmospheric pressure. The chamber was equipped with a thermostat and circulating fan to maintain a constant temperature of 20°C. [68°F.].

The results obtained after an exposure of one hour indicated that the effective insecticidal concentration would lie between 100 and 1,000 parts per million ; *Citrus* seedlings were injured by exposure to the latter rate. Comparison of these results with those of experiments with hydrocyanic acid gas indicated that fluorine is about as toxic as the latter to *A. aurantii* and to *T. confusum.*

DEAN (R. W.). **Plum Curculio Control with Chlorinated Hydrocarbon Insecticides in 1947.**—*J. econ. Ent.* **41** no. 3 pp. 524–525, 2 refs. Menasha, Wis., 1948.

In tests on the control of the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apple and peach in eastern New York, several new insecticides were compared with the standard lead-arsenate treatment. All spray quantities are given per 100 U.S. gals., and micronised wettable sulphur was included in all sprays. Cortland apples received a calyx spray on 28th May, a curculio spray on 4th–5th June and a first cover spray on 12th June. The percentages of fruits scarred, between which a difference of 12·36 was required for significance, were 61·22 for no treatment, 1·97, 2·90 and 4·57 for 3, 4 and 2 lb. 50 per cent. wettable chlordan powder, 15·09 for chlordan emulsion at 1 U.S. pint (containing 1 lb. technical chlordan), 4·67 for a combination of 2 lb. lead arsenate and 2 lb. 50 per cent. wettable DDT powder, which is less expensive than chlordan powder, 6·11 for 2 lb. 50 per cent. wettable methoxy-DDT powder, 6·71 and 25·70 for the standard spray of 3 lb. lead arsenate and 3 lb. lime, with and without the addition of 1 U.S. pint of a polyethylene polysulphide adhesive [*cf. R.A.E.*, A **37** 308], 22·48 for a spray of 2–3 lb. lead arsenate and 2–3 lb. wettable BHC (benzene hexachloride) containing 6 per cent. γ isomer, and 53·06 for 3 lb. BHC powder applied alone on the same dates as the other sprays and also on 18th June.

In the tests on peach, the standard spray of 2 lb. acid lead arsenate and 16 lb. lime was applied on 29th May, at shuck-fall, and the other materials, except BHC, on that date and 9th June, with a third application of methoxy-DDT and chlordan on 18th-19th June. BHC (3 lb. 50 per cent. wettable powder) was applied four times at weekly intervals between 29th May and 18th June. Chlordan, used at 2–4 lb. 50 per cent. wettable powder or 1 U.S. pint emulsion, was very effective in reducing both scarred fruits and infested dropped fruits, and methoxy-DDT at 2 lb. 50 per cent. wettable powder was not significantly less effective. BHC gave approximately the same control of total injuries as chlordan, but resulted in more scarred fruits and fewer infested dropped fruits than any other treatment or none. The standard spray and one of 4 lb. basic lead arsenate with 4 lb. lime were ineffective.

The apparent lack of control by BHC on apple may be due to the fact that it does not affect the adults, which cause the fruit scarring that is the main form of injury to apple in the Hudson Valley area. Differences in the amount or persistence of spray deposits on the different surfaces of the two fruits may also be important.

DUBOIS (K. P.) & MANGUN (G. H.). **Effect of Hexaethyl Tetraphosphate on Choline Esterase** *in vitro* **and** *in vivo.*—*Proc. Soc. exp. Biol. Med.* **64** no. 2 pp. 137–139, 1 fig., 1 ref. New York, N.Y., 1947.

The following is the authors' summary. Hexaethyl tetraphosphate exerts a strong inhibitory effect on mammalian and insect cholinesterase *in vitro* and *in vivo.* This finding, in conjunction with its gross effects on animals suggests that its physiological effects may be due at least in part to its inhibition of this enzyme.

WEIDMAN (R. H.) & ROBBINS (G. T.). **Attacks of Pitch Moth and Turpentine Beetle on Pines in the Eddy Arboretum.**—*J. For.* **45** no. 6 pp. 428–433, 1 ref. Washington, D.C., 1947.

An account is given of observations on the infestation of pines in an arboretum in California by *Vespamima sequoiae*, Hy. Edw., and *Dendroctonus* *valens*, Lec., made during a control survey in the summers of 1943 and 1944. The arboretum contained 70 species and some 35 varieties and hybrids of native and exotic pines 16–18 years old, and the two insects were common on *Pinus ponderosa* in the surrounding forest. The eggs of *V. sequoia* are laid in crevices and wounds in the bark in July, and the larvae tunnel into the inner bark, where they remain for two winters. A characteristic exudation of resin accumulates at the entrance to the galleries ; both larvae and pupae are tolerant of resin and are not drowned by the excessive flow. The attack injures the tops, but does not kill the trees, though it may render them more susceptible to infestation by *Dendroctonus* and *Ips*. It is not of great importance in timber stands, but control is desirable on shade and ornamental trees. *D. valens*, which was less common, also renders the trees susceptible to attack by other insects. All stages are present throughout the year, but infestation is heaviest in midsummer. The trees are attacked near the ground ; the adult forms a conspicuous tube of reddish resin, and the larvae construct a chamber occupying an area of several square inches that becomes filled with wood dust and resin.

The results of the survey are shown in tables. In all, 32 species, one variety and four hybrids were attacked by *V. sequoiae*, but four species and two varieties were attacked in one year only. The trees most heavily attacked in both years were *P. pinaster*, *P. sylvestris*, *P. sabiniana*, *P. pungens*, and *P. halepensis* ; some 50 per cent. or more of each was infested, and the number of attacks per tree was high. All native hard pines were attacked, but, with the exception of *P. sabiniana*, less severely than introduced ones. Reasonably good evidence for the existence of specific differences in attractiveness was obtained ; 5-needle soft pines and nut pines were not attacked and may be unattractive owing to their smooth bark while young. There seemed to be no relation between the susceptibility of *P. ponderosa* from different districts and the climatic conditions at the place of origin. The trees were attacked chiefly in crevices in the bark, especially at the crotches, at wounds where branches had broken off or been removed in pruning, or, particularly in *P. sylvestris* and *P. halepensis*, at holes drilled in the wood by birds. Nearly 2,750 masses of resin were removed in the two years, and most contained only one larva or pupa.

In 1943, *D. valens* attacked 90 trees of 17 species. The most heavily infested were *P. pungens*, *P. resinosa*, and *P. banksiana*, with percentage infestations of 61, 55 and 32, respectively. In 1944, only 17 trees were attacked, but they included two species and a hybrid that were not infested in 1943 ; the three most heavily attacked were *P. virginiana*, *P. resinosa* and *P. banksiana*. Introduced pines were more susceptible than indigenous ones, and pruning scars, accidental wounds and holes drilled by birds did not appear to attract the beetles. The resin tubes were apparently newly made when the trees were examined in July 1943, but by August, many had dried and some were closed by resinous exudations ; many dead beetles were found embedded in the resin in both years, and it was evident that few had penetrated to the inner bark.

The method of control adopted against both insects was digging out the larvae and pupae, removing accumulations of resin and coating the cavities with an asphalt dressing.

LEJEUNE (R. R.). **Status of the Larch Sawfly,** ***Pristiphora erichsonii*** **Htg. in the Prairie Provinces.**—*Canad. Ent.* **79** no. 7–8 pp. 130–134, 16 refs. Guelph, Ont. [1948.]

Extensive stands of young larch in the Prairie Provinces of Canada are in danger as a result of an outbreak of *Pristiphora erichsonii*, Htg., that began there about 1938 and is the third to be reported from that area since about 1910. It originated in central Manitoba and now extends into eastern

Saskatchewan and north-western Ontario, and has been particularly severe in parts of Manitoba and Saskatchewan. The stands are on swamps previously occupied by more mature trees that were destroyed by earlier outbreaks; they have great potential commercial value, and are also of importance in water conservation, since they occupy land that would otherwise be barren.

The sawfly oviposits from late May until early July and reproduces parthenogenetically; less than 1 per cent. of the adults obtained in extensive laboratory rearings were males. The eggs are inserted in double rows in slits in the tips of the young twigs, usually along the underside, as a result of which the growth of that side of the twig is retarded and the tip curls in a characteristic manner. The larvae hatch in about a week and feed gregariously on the needles; most have completed their feeding by the end of July, but some may feed throughout August. They overwinter in cocoons in the soil at depths down to about 6 ins., depending on the amount of cover. Feeding begins at the tips of the crowns, and if the infestation is light, only these are stripped of needles; since the foliage is proportionately more abundant lower down, the trees usually withstand this damage for many years. When infestation is heavy, the trees may be completely defoliated in a few months; studies in sample plots showed that the trees can withstand repeated heavy defoliation, but there was some mortality among trees in which it reached 90 per cent. in three successive years.

Control by introduced parasites had not proved altogether satisfactory [*R.A.E.*, A **37** 271], despite the early success of *Mesoleius aulicus*, Grav. (*tenthredinis*, Morl.) [**16** 450]. Mice and shrews destroy more cocoons than the parasites in well-drained swamps, where mortality due to them varied from 10 to 60 per cent. with an average of 37 per cent. in Manitoba in 1939–45; the proportion so destroyed in wet areas is negligible. Insecticides might be of value against incipient outbreaks and in valuable stands, and DDT and BHC (benzene hexachloride) applied at rates of ½, 1 and 2 lb. per acre in small-scale preliminary experiments, gave excellent control. The lowest rate was almost as effective as the highest, but where application is to be by means of aircraft, a rate of at least 1 lb. per acre would be desirable. BHC appeared to be the more toxic immediately after application, but DDT was in general the more effective three weeks later. A method of control under investigation is the regulation of water levels in swamps. Preliminary evidence indicates that submergence of the cocoons for a limited period may be lethal, and trees in swamps with high water levels are free from damage, even in areas where populations are high. Where flooding is not possible, surface drainage to provide conditions favourable for small predatory mammals might be beneficial. Any dead trees of marketable size should be salvaged, and since the wood remains sound longer than most softwoods, salvage can be continued over extended periods. It is pointed out that trees that appear to be dead but do not show evidence of deterioration through insects or disease or of loosening of the bark, may still be alive.

KINGSCOTE (A. A.). **Preliminary Report on the Effect of DDT upon "Sow Bugs" or "Woodlice" (Oniscoida).**—*Canad. Ent.* **79** no. 7–8 p. 149. Guelph, Ont. [1948.]

Larval and adult woodlice placed with moistened pieces of paper and single slices of potato ½ in. in diameter as food in petri dishes that had been lightly dusted with a proprietary powder containing 32 per cent. DDT showed signs of incoordination in 15 minutes, and all died within 21 hours. The controls remained normal and were still living a fortnight later. These tests indicate, in addition to the possible value of DDT in controlling woodlice, that the latter are convenient test animals for use with this insecticide [*cf.* *R.A.E.*, A **33** 197].

HOPPING (G. R.). **Notes on the seasonal Development of** *Medetera aldrichii* **Wheeler (Diptera, Dolichopidae) as a Predator of the Douglas Fir Bark-beetle,** *Dendroctonus pseudotsugae* **Hopkins.**—*Canad. Ent.* **79** no. 7–8 pp. 150–153, 3 figs., 1 ref. Guelph, Ont. [1948.]

The following is virtually the author's summary. *Medetera aldrichii*, Wheeler [*cf. R.A.E.*, A **23** 386] is an important predator of *Dendroctonus pseudotsugae*, Hopk., on Douglas fir [*Pseudotsuga taxifolia*] in the southern interior of British Columbia. Log analyses have shown that the larval population of this fly sometimes averages 10 per square foot of log surface compared to bark-beetle populations varying from 23 to 63 per square foot. Evidence indicates that each larva destroys several bark-beetle larvae during its development. The eggs are laid in crevices of the bark between mid-June and early August and hatch in about nine days. The larvae overwinter in the trees and pupate during late April or May. Over 1,200 larvae are sometimes present in one tree. The pupal period lasts about one month. The rates of mortality of the bark-beetle and *M. aldrichii* in one tree were both 93 per cent. between July of one year and the time of emergence in the next ; they were 77 and 82 per cent., respectively, in another between September and emergence. Only one other predator, *Enoclerus sphegeus*, F., seems to be as effective as *M. aldrichii*.

PERRAULT (C.). **Etudes sur la pourriture du cerne des pommes de terre causée par** *Corynebacterium sepedonicum* **(Spieck. & Kott.) Skaptason & Burkholder. 1. Les agents de dissémination.**—*Sci. Agric.* **28** no. 6 pp. 244–260, 1 fig., 26 refs. Ottawa, 1948. (With a Summary in English.)

Experiments in the Province of Quebec begun in 1937 showed that potato ring rot, caused by *Corynebacterium sepedonicum*, is disseminated mainly by infected tubers, knives, planting and digging machines and containers. It has been thought that insects are responsible for transmission [*cf. R.A.E.*, A **30** 5; **31** 114], but various species commonly found in potato fields in the lower St. Lawrence failed to transmit the disease from infected to healthy plants under experimental conditions. When 71 insects collected from infected plants in the field and comprising *Leptinotarsa decemlineata*, Say, *Epitrix cucumeris*, Harr., *Lygus oblineatus*, Say (*pratensis*, auct.), *Philaenus pallidus*, Zett., and an undetermined Aphid were crushed and examined microscopically, some of each species were found to contain bodies resembling *C. sepedonicum*.

GÜNTHART (E.). **Die Bekämpfung der Engerlinge mit Hexachlor-cyclohexan-Präparaten.** [The Control of Cockchafer Larvae with Preparations of Benzene Hexachloride.]—*Mitt. schweiz. ent. Ges.* **20** pt. 5 pp. 409–451, 16 figs., 18 refs. Berne, 1947. (With a Summary in French.)

A detailed account is given of experiments in Switzerland in 1945 and 1946, most of which have already been noticed [*R.A.E.*, A **36** 279], in which it was found that BHC (benzene hexachloride) could be effectively used in suspensions, emulsions and inert dusts and in admixture with chemical fertilisers to control larvae of *Melolontha* in the soil. In many of the tests, proprietary emulsions of carbon bisulphide or DDT were compared with BHC. Neither gave such good results, and DDT lost its effect in a few weeks, whereas soil treated with BHC in an inert dust was still toxic to the larvae after a year, its effectiveness increasing with the amount originally applied.

BHC is likely to affect the flavour of root crops, and these should not be grown in treated soil until two years after the treatment, but it can be used without danger in plant nurseries, plantations of young fruit trees or bushes, flower gardens and shrubberies. It should be applied early, in April if possible, before the larvae have fed much.

Meyer (A.). **Untersuchungen über die Bekämpfung des grauen Lärchenwicklers** (*Semasia diniana* **Gn.**) **in den Wäldern des Ober-Engadins.** [Investigations on the Control of the grey Larch Tortricid in Forests of the Upper Engadine.]—*Mitt. schweiz. ent. Ges.* **20** pt. 5 pp. 452–474, 7 figs., 7 refs. Berne, 1947.

In June and July 1946, an outbreak of *Enarmonia* (*Semasia*) *diniana*, Gn., occurred in the forests of the Upper Engadine. Larch was the principal food-plant, but other conifers were also attacked in mixed stands. The larvae not only render the trees unsightly by their feeding and reduce the usual growth, but are a nuisance to visitors in the forest. All stages of the moth are described, a brief account of its bionomics is given [*cf. R.A.E.*, A **27** 169; **33** 400], and the losses caused by it are discussed. Previous outbreaks in the Upper Engadine are reviewed, and it is concluded that their occurrence is regulated by a number of factors, of which natural enemies are the most important. They mostly last three years. Infestation is sporadic in the first year but spreads to practically the whole of the forest in the second, though stands that were infested in the preceding year are less attacked. The outbreak dies down in the third year, and the larvae are less active. The weather seems to have no direct effect on the increase, except that development may be retarded in rainy and cold periods.

Following a small-scale experiment in 1945, in which severely infested young larches were completely freed from larvae of *E. diniana* by a single application of a 2 per cent. DDT spray, and one in 1946 in which all larvae on a branch were killed by dusting it with DDT, a large-scale trial with a proprietary DDT dust was carried out on 6th and 7th June 1946 in two heavily infested forest areas. The dust was applied from the ground by means of a power duster, rose to a height of some 100–115 ft., well above the tops of the trees, and settled over a wide area. The larvae began to let themselves down on silk threads in large numbers 15–30 minutes after dusting, and in 24 hours most of them were dead and hanging from the trees in long chains. Counts on sheets placed in three different sites in the treated areas showed that very few other insects or spiders were killed. Ants that were directly hit on the trees died, but the colonies in the nests were not affected. Bees in the two beehives in the treated area appeared to be unharmed. Examination of random branches from treated and untreated areas in July showed that whereas most of the trees in the latter had been completely defoliated, a large proportion in the former were undamaged and many more only slightly injured. The contrast between the treated and the untreated parts of the forest was striking, the trees in the former showing normal colour and no increase in damage, whereas the untreated trees were reddish-brown, completely defoliated and covered at the tops with the silver webs of the larvae. The action of the DDT must have been rapid, since continuous heavy rain completely washed the dust off the trees in one area two days after it was applied, without reducing the control.

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Hamman (R. E.). **Factors involved in poisoning German Roaches** [*Blattella germanica*, L.] **by exposing them to Surfaces treated with Chlorinated Hydrocarbons** [DDT, benzene hexachloride, chlordan and toxaphene (chlorinated camphene)].—*J. econ. Ent.* **41** no. 3 pp. 516–517. Menasha, Wis., 1948. [See *R.A.E.*, B **37** 206.]

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LIBRARY LACUNAE.

The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Director, Commonwealth Institute of Entomology, 41, Queen's Gate, London, S.W.7.

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